Group Structure and Behaviour in Microfinance: Empirics from Sierra Leone

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A thesis submitted for the degree of
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Abstract

The use of group lending for poverty alleviation is a widespread feature of modern microfinance. The structure of joint-liability credit - if one member defaults the others are held financially responsible - produces a natural tension between a borrower's social and economic interests. This study integrates theory from economics, sociology, and behavioural experiments to address the question, "How do social and economic mechanisms interact to shape a microcredit group's financial behaviour?"

The empirical analysis involves an original dataset from a microfinance institution in Sierra Leone. The total dataset includes 7,025 joint-liability borrowers involved in 47,931 repayment transactions from 2005 to 2011. The empirical methods used are diverse: ethnographic fieldwork, GPS spatial analysis, social affiliation survey design, and multilevel statistical analysis of loan performance data. The original work is structured as three distinct papers.

In the first paper, I examine social collateral, the formal use of a borrower's relationships as security against loan default. How does a group's spatial structure affect the efficacy of social collateral? Spatial concentration improves a group's economic performance up to a certain level after which the effect reverses and performance declines. The relationship is driven by a social trade-off between ability and willingness to enforce the loan. Further, groups that consist of multiple spatial fragments produce worse performance. Spatially fragmented groups are prone to splitting into social factions.

In the second paper, I question what drives the self-selection process of microcredit group formation. The results show that group leaders prefer members with pre-existing social ties, who are spatially proximate, and have matching business types. The preference for socio-spatial factors is likely motivated by reducing the risk of strategic default by group members.

In the third paper, I explore how economic cooperation in small groups evolves over years of repeated interaction. Despite the selective retention of better performing groups, average cooperation rates consistently decline, in terms of contribution and effort. Further, variance across groups continues to increase over 30 months of repeated interaction, suggesting that convergence to a stable cooperation rate has not occurred. Given that group lending exhibits many of the factors found to promote cooperation in laboratory experiments, it is surprising to find such a marked decline in this field setting.

Overall, this thesis contributes to economic sociology by dissecting the difficult trade-offs between social and economic motives in group lending and offers policy implications for microfinance institutions regarding group formation heuristics, contract design, and loan management.

To friends in Sierra Leone

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Publications in Preparation

From this thesis, four distinct works are in preparation for publication. Chapter 2 is forthcoming in a book to be published by Oxford University Press. The other three chapters are in preparation for peer-reviewed journals, one of which, Chapter 4, has been submitted to date.

- Chapter 2: Sabin, N. (Forthcoming) Modern Microfinance: A Field in Flux. Chapter in Social Finance. Editors: Nicholls, A., Paton, R., & Emerson, J. Oxford: Oxford University Press.

- Chapter 4: Sabin, N. & Reed-Tsochas, F. (2014) The Structure of Social Collateral: Embeddedness and Economic Performance in Microfinance. *In Preparation.*

- Chapter 5: Sabin, N. (2014) Joint Liability Group Formation: Member Preferences through Selection Order. *In Preparation*.

- Chapter 6: Sabin, N. & Reed-Tsochas, F. (2014) The Evolution of Economic Cooperation in Small Groups. *In Preparation*.

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1 Introduction

1.1 Microfinance and the Use of Group Lending

Over the past three decades, there has been dramatic growth in the use of microfinance for global poverty alleviation. As of 2012, microfinance institutions (MFIs) were serving over 200 million clients globally (Reed et al, 2014). The motivation for this movement has been that without access to the conventional financial market, the working poor are often trapped in a cycle of poverty (Armendáriz & Morduch, 2010). Offering small-scale financial services poses a potential exit from this cycle by providing a means for bottom-up economic development (*ibid*). In particular, access to 'microcredit' in developing countries, typically involving small loans less than $1,000 USD for investment in self-employment activities, has been at the core of the microfinance movement (Yunus, 2011).

However, microfinance is not simply conventional finance on a smaller scale (Yunus, 1998). For example, an MFI attempting to lend to the poor in a developing country is often faced with severe challenges, most notably: (1) a lack of information such that the MFI is unable to assess the riskiness of a client (Ghatak, 1999); (2) a lack of financial collateral on the part of the borrower to back the loan (Besley & Coate, 1995); and, (3) limited ability of the MFI to enforce repayment of the loan (*ibid*). Though these challenges are general to banking, their severity requires unique solutions. A core innovation of the microfinance movement has been the use of group lending (Morduch, 1999). Instead of offering loans to individual clients, the MFI offers a joint-liability loan to a group of clients, such that if a borrower defaults, the other group members are held financially responsible. MFIs incorporating this approach have experienced significantly higher repayment rates than previous historical attempts at

lending to the poor (*ibid*). The basic intuition behind the success of group lending is that it draws on some form of 'social collateral' (Besley & Coate, 1995). However, despite the widespread use of group lending by MFIs, our understanding of how group lending works is highly limited (Karlan, 2007; Ditcher & Harper, 2007).

1.2 Research Motivation

The study of group lending is both of theoretical interest and practical value. Theoretically, it lies at the very intersection of social and economic logics (Anthony, 2005). How do clients behave when their decisions have direct impact on their personal relationships as well as their economic interests? Despite the entwined nature of these motives, research on group lending often does not effectively integrate theory from sociology and economics.

In my review of the literature on group lending, I draw on Granovetter's (1985) critique of under- and oversocialized views of economic action. He notes that undersocialized perspectives, i.e. those based on atomistic, self-regarding actors, and oversocialized perspectives, i.e. those based on actors driven by obedience to internalized norms, both paradoxically remove actors from the more subtle system of social relations in which they are embedded. Such perspectives significantly bias our understanding of the mechanisms underlying group lending. I draw on theory from sociology (e.g. Coleman, 1988; Uzzi 1996), economics (e.g. Stiglitz, 1990; Ghatak 1999), and interdisciplinary research on the emergence of cooperation (e.g. Nowak & Sigmund, 2005; Fehr & Gintis, 2007) to advance our theoretical depiction of microfinance and contribute to the growing field of economic sociology (Polanyi, 1944; Granovetter, 1985). Thus, the overarching question that directs this research is how do

social and economic mechanisms interact to shape a microcredit group's financial behaviour?

This thesis is also motivated by practical implications for poverty alleviation. Microfinance has grown from a small number of institutions in the 1970s to a connected global industry by the 2000s (Robinson, 2001). With this growth, microfinance has often been heralded as a key tool for poverty alleviation. In 2006, Muhammad Yunus and the Grameen Bank were awarded the Nobel Peace Prize for promoting economic and social development in Bangladesh. However, in recent years microfinance has become more controversial. As Morduch succinctly stated in 2011, "Proof of concept... is not proof of impact" (1271). Recent impact studies suggest that the impact of microfinance is not as significant as expected (Banerjee et al, 2010; Crépon et al, 2011; Karlan & Zinman, 2011). In addition, some microfinance markets fuelled by commercial funding have almost collapsed, for example that of Andhra Pradesh, India (CGAP, 2010).

Such issues have caused practitioners and researchers to rethink what the basic microfinance product offering should be in order to best serve the poor (Morduch, 2011). At the centre of this debate is the role of group lending. Do the economic benefits of group lending outweigh the social costs placed on borrowers (Giné & Karlan, 2007; Attanasio et al, 2012)? Despite its widespread use, our understanding of how group lending works is fairly limited. The practical goal of this thesis is to help practitioners and policy makers make informed decisions regarding how group lending works and its appropriate role for the future.

1.3 Research Approach and Empirical Context

My overall approach for studying group lending can be summarized in terms of three objectives: (1) to build on a strong theoretical foundation that integrates social structure and economic action (Polanyi, 1944; Granovetter, 1985; Coleman 1988); (2) to apply a research redesign that allows for the systematic analysis of both social and economic factors (see e.g. Burt, 1992; Uzzi, 1996; Karlan 2007); and, (3) by collecting and making use of fine-grained empirical microfinance data.

Empirically, a lack of quality data has been a consistent roadblock to researching microfinance (Karlan, 2007; Ditcher & Harper, 2007). However, for this research I was able to gain access to a very rich dataset from an MFI in Sierra Leone, with which I previously worked. The organization's borrower-level loan portfolio serves as the core dataset for the statistical analysis. The dataset includes over 18,000 borrowers and tracks their detailed repayment history from 2005 to 2011. This is a unique, previously unanalyzed dataset that provides significant empirical value. The organization also agreed to support the collection of supplemental data through surveys and interviews.

To address the research question, I utilize mixed methods, both qualitative and quantitative. Many researchers have noted the limitations of using purely statistical or purely qualitative methods in an attempt to understand the relationship between social relations and economic outcomes, suggesting that researchers need to be more open to the use of alternative methods and additional forms of evidence (Durlauf & Fafchamps, 2004). Furthermore, pure reliance on statistical correlation offers limited insight to underlying mechanisms and limits the study's ability to achieve causal depth (Hedström & Bearman, 2009).

To overcome these challenges, the analysis includes multiple data types. I summarize them here in order of increasing sample size (see Table 1.1). First, I conducted 64 interviews with microcredit borrowers as well as 9 interviews with microfinance staff members. The interviews totalled 56 hours. This qualitative research was critical for formulating hypotheses regarding group lending behaviour. Furthermore, the interviews were useful for the interpretation of subsequent statistical analysis. Second, I conducted a member order selection survey. Selection order, social connection to the group leader, and associated member characteristics provide insight into what motivates the group formation process. Third, I conducted a social affiliation survey with the support of the microfinance staff. This data provides systematic evidence of social ties between borrowers. Fourth, I collected fine-grained GPS spatial data on the residences of borrowers. Spatial proximity is a key factor affecting social interaction in terms of likelihood of a personal relationship and frequency of interaction (Festinger, Back, and Schachter 1950). This larger sample provides statistical benefits for testing hypotheses regarding social behaviour. Fifth, all the above data types were merged with the microfinance institution's loan portfolio data. The loan portfolio contains information on borrower characteristics, business characteristics, loan terms, and loan repayment.

Table 1.1: Summary of Data Types and Sample Sizes

Data Type	**Sample Size**
Interviews	n = 64 borrowers; 9 staff members
Member Selection Order Survey	n = 140 borrowers (33 groups)
Social Affiliation Survey	n = 410 borrowers (101 groups)
GPS Spatial Data	n = 1,884 borrowers (406 groups)
Subset Group Loan Portfolio Data	n = 7,025 borrowers (1,592 groups)
Entire Loan Portfolio Data	n ≈ 18,000 borrowers

Data Source: Microfinance Institution in Sierra Leone

I collected all the supplemental data, i.e. not including the loan portfolio data, during three months of fieldwork in Sierra Leone during 2011. The MFI is located in semi-rural and rural areas of the country. The MFI's mission is "to reduce poverty among the economically active poor by providing sustainable access to financial services" (MFI, 2007, 2). In operational terms, the organization has primarily adopted a "solidarity group lending methodology" for clients who are mostly self-employed individuals (*ibid*). In Sierra Leone, over 70 percent of the population of 6.5 million live below the poverty line (UNDP, 2004). In sum, this unusually high-quality microfinance dataset reflects a standard model of using group lending for poverty alleviation.

1.4 Summary of Original Contributions

Chapter 2, *Modern Microfinance: A Field in Flux*, places this research in its broader empirical context. The approach is to combine practitioner and academic resources to characterize the current state of the microfinance field. The chapter is forthcoming in a volume entitled *Social Finance*, to be published by Oxford University Press. The chapter captures the shift over the last decade from one of broad support (e.g. Robinson, 2001; Yunus 2003) to a more contested outlook (e.g. Karnani, 2007; Bauchet et al, 2011). The first half of the chapter describes how microfinance emerged from its historical predecessors, such as community associations and State-Owned Development Banks, and was pioneered by a small set of institutions in Asia and Latin America (Morduch, 1999). The modern microfinance landscape is then characterized in terms of scale, geographic coverage, institution size, and organisational type. The second half of the chapter is structured around three ongoing debates in microfinance: the critical features of microfinance, the appropriate role of commercialization, and the assessment of its impact. These topics reflect unresolved questions which will fundamentally shape how the field evolves in the future. In terms of these three debates in the field, the original contributions of this thesis relate primarily to the first debate, the critical features of microfinance.

Chapter 3 is a general literature review that provides the theoretical background for the following original work. The review covers three bodies of literature: (1) group lending, both theoretical and empirical studies; (2) economic sociology, pertaining to embeddedness, social capital, and social network analysis; and (3) experimental literature on social behaviour and economic cooperation. Following the literature review, each chapter is presented as a distinct research paper. As such, they contain separate

abstracts, literature reviews more targeted to the specific topics, and individual appendices supporting the different empirical analyses.

Chapter 4, *The Structure of Social Collateral: Embeddedness and Economic Performance in Microfinance*, addresses one of the key concepts in group lending: the use of a borrower's relationships as security against loan default. The paper draws on economic sociology theory and primarily targets a sociology audience. Much of the prior empirical work on social collateral has produced inconsistent findings regarding its effects on group repayment (Hermes & Lensink, 2007). We argue that contradicting results stem from undersocialized perspectives of actor behaviour (Wrong, 1961) and coarse-grained empirical data. We employ an embeddedness framework (Granovetter, 1985) to highlight the importance of the social structures in which borrowers are embedded. This paper makes a methodological contribution by integrating ethnographic fieldwork on social collateral with the statistical testing of hypotheses. This approach allows for stronger theory development regarding the social mechanisms that underlie microcredit behaviour.

The paper's empirical contribution involves fine-grained, systematic analysis of how variation in a group's spatial structure shapes its social interactions and resulting repayment behaviour. This can be contrasted with much of the prior empirical work involving coarse-grained measures of a group's structure. For example, Wydick's (1999) study uses a binary measure of a group's social cohesion. Our findings highlight two features of a group's structure: spatial concentration and spatial fragmentation. We find that spatial concentration improves a group's economic performance up to a certain level, after which performance declines. Embeddedness enhances performance through greater ability to sanction, communicate, and build solidarity. However, in overembedded groups there is a significant decline in willingness to enforce the loan on

group members despite the potential ability to do so. We also find that groups consisting of distinct spatial fragments perform worse than groups without spatial fragments. Such groups are at risk of splitting into factions.

The most similar empirical work to this paper is Karlan's (2007) *Social Connections and Group Banking*. In contrast to Karlan's findings, we find that spatial concentration does not have a monotonic relationship with group repayment. The groups in his study were quasi-randomly assigned, as opposed to self-selected groups. It is likely that Karlan's study did not have as great a proportion of high-concentration groups. Our study offers additional insight into the full spectrum of structural embeddedness and draws attention to the economic risks of overembedded groups.

Chapter 5, *Joint Liability Group Formation: Member Preferences through Selection Order*, shifts our attention to the endogenous group formation process. How microcredit groups form is an understudied topic that has significant implications for who gains access to microfinance and the repayment behaviour of the resulting groups (Berhane, Gardebroek & Moll, 2009). This paper draws on theory and methods intended for an economic development audience. Most prior work on this topic views social factors as frictions in the matching process. The most cited theoretical work is based on assortative matching of risk profiles (Varian, 1990; Ghatak, 1999), but has found little or no empirical support (Sadoulet & Carpenter, 1999; Lensink & Mehtreab, 2002). In this paper, I develop a model for the microcredit group formation process incorporating both social and economic mechanisms. The work builds on related research on informal risk sharing in developing economies (e.g. Fafchamps & Gubert, 2007).

The paper in Chapter 5 also involves a unique method for analyzing group formation. Rather than looking at the composition of resulting groups (Arcand & Fafchamps, 2012), I collect and analyze the order in which members are selected. This

ordering provides insight into the actual selection process, indicating which borrower characteristics are preferred. The data indicates that group leaders prefer members with which they have pre-existing social ties, who are spatially proximate, and have matching business types. Notably, there is no evidence of within-group preference for borrowers with financially stronger businesses. I argue that the emphasis on socio-spatial factors may be motivated by reducing the risk of members strategically defaulting in a joint-liability contract.

Chapter 6, *The Evolution of Economic Cooperation in Small Groups*, adopts a different approach to the prior two papers. In this paper, we seek to make a contribution to the wider interdisciplinary literature on the emergence of cooperation and use microfinance data to test the validity of findings from laboratory experiments involving cooperative games. Carefully controlled laboratory experiments are often viewed as the most direct way to distinguish between different causal mechanisms. Research employing this approach has identified numerous factors affecting whether economic cooperation propagates in the laboratory (e.g. Fehr & Gintis, 2007; Chaudhuri, 2011). However, such studies are often limited in regards to meaningful stakes, sample size, and study duration. Our paper complements this body of research by analyzing a real-world cooperative dilemma in which the stakes are of critical importance to the participants and their behaviour is tracked in a large sample over years of interaction.

We find that though cooperation rates in microcredit groups start out high, they consistently decline over time, both within and across loan cycles. This decline is notable because microcredit groups possess many of the structural features known to promote cooperative behaviour. Furthermore, this trend occurs despite the selective retention of better performing groups by the MFI. We also find that variance across groups increases over time. Even after years of monthly repayments, aggregate

cooperation has not converged on a stable rate. This paper raises important questions regarding how cooperation can be maintained in real-world economic settings.

Chapter 7 concludes the thesis by viewing the contributions of the papers more holistically. Implications for microfinance policy are distilled into three topics: group formation, contract design, and loan management. I suggest that the risk of overembeddedness can be partially mitigated during the group formation process via loan officer heuristics. In regard to contract design, it may be possible to maintain some of the positive benefits of group lending, for example solidarity and peer support, while reducing the financial burden on borrowers. This could be implemented by removing the formal joint-liability contract, but by maintaining public repayment meetings. In terms of loan management, the decline in cooperation rates over loan cycles suggests that MFIs may benefit from more actively transitioning group borrowers to individual contracts, once the group has demonstrated sufficient performance. These policy suggestions require further validation involving complementary research designs and other cultural contexts. I close with guidance for future research integrating economic sociology and microfinance.

2 Modern Microfinance: A Field in Flux

2.0 Abstract

Modern microfinance is a field in flux. The market structure is shifting, with organizations increasingly accessing commercial funding. Some geographic markets have overheated, producing substantial criticism. Recent impact evaluations are raising questions about what microfinance actually can and should attempt to achieve. Even the basic offering is being rethought in terms of products and services that may better suit the needs of the poor. This chapter is an overview of the current status of modern microfinance, drawing on both practitioner and academic resources. Vignettes are included throughout to illustrate the trends and concepts. The first section provides a brief introduction to microfinance terminology and a review of historical predecessors to modern microfinance. The second section describes how the modern microfinance movement began and grew to its present form. The current landscape is characterized in terms of scale, geographic coverage, institution size, and organizational type. The third section details three of the most fundamental ongoing debates in microfinance: the critical features of modern microfinance, the appropriate role of commercialization, and the assessment of microfinance's impact. The final section concludes with implications for the broader field of social finance based on lessons learned from the microfinance movement to date.

2.1 Introduction

Microfinance is often cited as the success story of the broader social finance movement. Financial access for poor and low-income clients has expanded dramatically over the last four decades to include over 3,500 microfinance institutions reaching over 200 million clients worldwide (Maes & Reed, 2012). The approach is often viewed as a clear example of using market-based principles to advance a social objective, in this case primarily the use of unsubsidized lending to alleviate poverty (Nicholls, 2006). The movement has also generated extensive public acclaim, such as the United Nations recognizing 2005 as the International Year of Microcredit and the Norwegian Nobel Committee awarding the Peace Prize to Dr. Muhammad Yunus and the Grameen Bank in 2006.

However, to characterize the microfinance movement as an uncontested success story lessens our ability to understand the challenges of pioneering the social finance space. A more nuanced view of microfinance reveals a field in flux faced with unresolved debates and ongoing changes. The market structure is shifting, with organizations increasingly accessing commercial funding (Glisovic et al, 2012). Some markets have overheated, producing substantial criticism (CGAP, 2010). Recent impact evaluations are raising new questions about what microfinance actually can and should attempt to achieve (Bauchet et al, 2011). Even the basic offering is being rethought in terms of products and services that will better suit the needs of the poor (Morduch, 2011). Amidst these developments, the global reach of microfinance continues to grow (Maes & Reed, 2012). In such a state of flux, it is increasingly important to understand both the unifying trends as well as the points of disagreement within the field.

The intent of this chapter is to provide an overview of microfinance by drawing on recent practical changes on the ground, as well as the latest research studies. To help place microfinance in context, the chapter begins with a brief introduction to terminology and a review of two key historical predecessors that were particularly relevant to the emergence of modern microfinance: informal community associations and State-Owned Development Banks. The following section describes how the modern microfinance movement began in the mid-1970s and grew to its present form. The current landscape is then characterized in terms of scale, geographic coverage, institution size, and organizational type.

The remaining content of the chapter is structured around three of the most fundamental debates in microfinance. Not only have these questions shaped the course of microfinance to date, but they are still unresolved and will likely direct the future of the field. The first topic concerns the critical features of the microfinance model. For decades, practitioners and researchers have grappled with understanding exactly what makes microcredit appear to work (e.g. Stiglitz, 1990; Attanasio et al, 2012). Some institutions are shifting their focus beyond credit, to include such products as microsavings and microinsurance (e.g. Dupas & Robinson, 2011; Karlan et al, Forthcoming). The second topic addresses the appropriate role of commercialization in microfinance. This issue has become increasingly polarized as organizations have begun accessing capital through public stock markets and sometimes generating substantial profits for shareholders (CGAP, 2007). Whether commercial funding represents a much needed capital source or a move in the wrong social direction may be the most contested issue in microfinance (see e.g. Yunus, 2011). The third topic concerns the actual impact of microfinance. The recent publication of several randomized controlled trials suggests that the impact of credit on microenterprise growth is more modest than originally hoped

(Bauchet et al, 2011). However, the upside of such studies is that microfinance programs often produce other unintended benefits for the poor, such as risk reduction and better cash flow management (Morduch, 2011). These findings are useful in that they suggest how microfinance might be reconceptualised to improve its social impact. The chapter concludes with implications for the broader field of social finance based on lessons learned from the microfinance movement to date.

2.2 Microfinance Terminology

A basic definition of microfinance is "financial services for poor and low-income clients" (Gonzalez & Rosenberg, 2006, 1). While this definition offers a good starting point, it is helpful to further clarify what is typically associated with the term 'microfinance'. Broadly, the idea and practice of small-scale financial services for the poor is not new. For example, informal savings and credit associations for impoverished communities have existed for centuries in many countries around the world (Helms, 2006). However, when the term 'microfinance' is used today, there is a general understanding in the industry that one is referring more narrowly to the movement that has taken shape over the last four decades built around a more specific financial model. It is common for this movement to be referred to as "modern microfinance" (Trezza, 2006, 20) or the "new microfinance" (Robinson, 2001, 224). In this chapter, usage of the term 'microfinance' will refer to this more narrow conception.

What are the primary features of the modern microfinance movement? The Grameen Bank, pioneered by Muhammad Yunus in Bangladesh during the 1970s, is often cited as the prototypical example of modern microfinance (Morduch, 1999). There are two key tenets to this type of model: (1) financial self-sustainability of the service provider and (2) targeting clients that are typically excluded from the formal financial

market. While not all microfinance institutions achieve financial self-sustainability, the intent is generally to charge interest rates and fees that allow the provider to cover its operational costs. This can be contrasted with the model of many State-Owned Development Banks from the 1950s to the 1980s that were built on the idea that credit to rural farmers had to be subsidized (Robinson, 2001). The second tenet of modern microfinance is social inclusion with the ultimate aim of poverty alleviation. This is borne out by typically targeting clients in developing countries that are often excluded, such as women and the poor (Yunus, 2003).

A further aspect of terminology that is useful to clarify is the distinction between microfinance and microcredit. Microfinance is a more general term that refers to a variety of small-scale financial services. Microcredit is a subset of microfinance that specifically refers to the provision of small loans. In addition to loans, microfinance can also include financial services such as deposits, insurance, payment services, and money transfers (Daley-Harris & Awimbo, 2011). Historically, the focus of microfinance has been on providing microcredit via group loans. Because of this, the majority of microfinance research to date has explored the features and effects of providing such loans. However, over the last decade there has been a substantial shift in attempting to provide a more complete set of services beyond microcredit (Armendáriz & Morduch, 2010).

2.3 Historical Predecessors of Modern Microfinance

The idea of small-scale financial services for clients excluded from the formal market has a substantial history. In development finance, it has been a perennial question as to why certain populations seem to be cut off from the global credit market (see e.g. Braverman & Gausch, 1986; Stiglitz, 1990). In response to this question, several reasons

have been suggested as to why providing loans in developing economies is difficult. Given the small loan amounts and high transaction costs, an institution needs to be highly efficient and maintain low default rates if it is to be financially sustainable. While this challenge is not insurmountable, a lender typically faces the additional difficulties of: scarce information on potential clients before issuing the loan; limited ability to effectively enforce the loan once it has been disbursed; and, a lack of collateral to rely on if the client goes into default (Besley & Coate, 1995). Taken together, these challenges create a daunting environment in which an institution is to be financially sustainable. Faced with such circumstances, what models for microfinance have been used in the past?

Two types of predecessors are particularly important for understanding the current movement: community associations and State-Owned Development Banks. Community associations, in particular Rotating Savings and Credit Associations (RoSCAs) and Credit Cooperatives, have been in use for centuries and are relevant for their use of group lending. These models are thought to have played a role in inspiring Yunus' ideas for the solidarity groups of Grameen Bank (Morduch, 1999). State-Owned Development Banks are relevant predominantly not for their successes, but because their failed attempts from the 1950s to the 1980s provided such a strong impetus for the new microfinance model (Armendáriz & Morduch, 2010).

2.3.1 Community Associations

The roots of group lending can be traced to a type of community association known as the RoSCA (Geertz, 1962; Besley, Coate & Loury, 1993). Ardner defines a RoSCA as an informal association "formed upon a core of participants who agree to make regular contributions to a fund which is given, in whole or in part, to each

contributor in rotation" (1964, 201). RoSCAs serve the function of allowing members to pool their money into lump sums without the involvement of formal institutions. If a member receives the lump sum earlier in the rotation, it can be viewed as that member having received a loan from the group. If a member receives the lump sum later in the rotation, the RoSCA has functioned more as a savings device for the member. This basic arrangement is used extensively around the world with a high degree of similarity.[1] Since the 19th century, RoSCAs have been documented under different names; for example, in China they have been referred to as *hui hui*, in Nigeria as *esusu*, and in Scotland as *menages*. There is written evidence of RoSCAs being used in Japan as far back as 1275 (Ardner, 1964).

An important feature of RoSCAs is that they are community based. They rarely start with a formal management or organizational structure, yet they typically have very high repayment rates. Many researchers have asked how the repayment rates are maintained. RoSCAs seem to avoid default problems by relying on the social cohesiveness of the group (Geertz, 1962; Ardner 1964; Besley et al, 1993). Not only can members provide positive support and solidarity, but there can be significant social cost in terms of pressure, embarrassment, or exclusion. Such social mechanisms are key features of the modern microfinance model.

A more formalized community organization for financial access is the Credit Cooperative. In contrast to RoSCAs, these cooperatives often have a formal charter and some legal status (Armendáriz & Morduch, 2010). Loans also tend to be larger, and are paid back over longer periods. In the cooperative model, the members are all shareholders, but not all the members are expected to take out a loan. The concept of

[1]There are notable variations on the basic model including organizer fees, group size, fund amount, frequency of repayment, determination of payout order, etc.

community lending is still central to the model as members have a say in setting the terms of credit access and an ongoing interest in ensuring that the loans are repaid. Cooperatives emerged in Germany during the late 19th century and are now seen internationally in countries as diverse as Ireland, France, Kenya, Malawi, and India (Huppi & Feder, 1990).

2.3.2 State-Owned Development Banks

While community associations are historically relevant for their often successful use of local cohesiveness, State-Owned Development Banks are relevant for demonstrating the limitations of subsidized credit programs. From the 1950s to the 1980s, there was a focus on development via government-mediated subsidies for the rural poor. Using external funding and formalized organizational structures, State-Owned Development Banks hoped to scale up financial services to the poor. Subsidized credit for farmers was the most common approach. Despite positive intentions, the results of such programs were broadly deemed a failure (Morduch, 1999). See the following vignette on India's Integrated Rural Development Program for a detailed example.

The programs often failed to achieve their development goals and resulted in very high default rates. Most government-subsidized credit programs in Africa, the Middle East, Latin America, and South Asia produced default rates between 40-95 percent during this period (Braverman & Guasch, 1986). Failure of these programs is often attributed to an inability to enforce the loans, corruption within the institutions, and the diversion of funds to better-off clients. The experience of State-Owned Development Banks led many to question whether such programs were a viable approach for

extending financial access to the poor. By the 1980s, it was clear that a different approach was needed.

Vignette: India's Integrated Rural Development Program

India's Integrated Rural Development Program (IRDP) during the 1980s is an example of an ineffective attempt at development by means of government-subsidized credit. Approximately $6 billion USD in subsidies was directed to the rural poor throughout the decade (Armendáriz & Morduch, 2010). The government's intentions were decidedly focused on social impact for farmers: "The imperative laid down for the plan for rural areas of the country is increasing productivity through a strategy of growth with social justice... More specifically, it involves a sharp focus on target groups comprising small and marginal farmers, agricultural labourers and rural artisans..." (Rath, 1985, 238).

Given the amount of money invested, the results were startlingly unimpressive. Why did the IRDP fail to achieve its goals? Critics often blame the performance of IRDP on several factors: endemic corruption, lack of infrastructure, and poor administration (Dreze, 1990). Others more generally disagree with subsidized credit programs, arguing that they are not sustainable and disrupt the financial market. The impact on poverty alleviation was a disappointment and default rates were over 40 percent. "More than any positive historical precedent, it is the repudiation of these negative legacies that has driven the microfinance movement to look to the private sector for inspiration" (Armendáriz & Morduch, 2010, 11-12).

2.4 The Modern Microfinance Movement

Following in the wake of the disappointing subsidized credit programs, the greatest accomplishment of modern microfinance has been the demonstration that poor clients can be reliable bank customers (Cull, Demirguc-Kunt, & Morduch, 2009). The rapid spread of the microfinance model has been described by some as a financial 'revolution' (Robinson, 2001). What is different about the modern microfinance movement and where did this innovative model come from?

Accounts of the pioneering microcredit institutions suggest that the model evolved from real world experimentation in low-income countries like Bangladesh, Indonesia, and Bolivia, (Armendáriz & Morduch, 2010). Credit is often given to Muhammad Yunus for developing the prototypical design of the Grameen Bank in Bangladesh during the 1970s. In his own words, Yunus was not attempting to fix the financial market, but rather to address a social problem: "I had no intention of lending money to anyone; all I really wanted was to solve an immediate problem.... the problem of poverty which humiliates and denigrates everything that a human being stands for" (Yunus, 1998, 12). The late 1970s was an experimental phase for Yunus and his colleagues: "We did not know anything about how to run a bank for the poor, so we had to learn from scratch. In January 1977, when we started, I looked at how others ran their loan operations, and I learned from their mistakes" (*ibid*, 104).

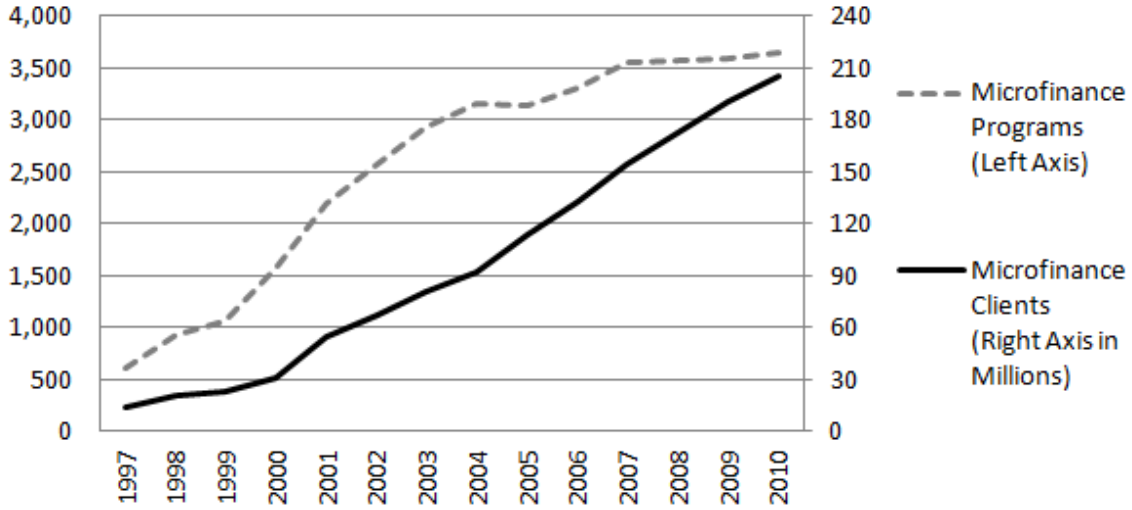
From the beginning, Yunus focused his lending scheme on female borrowers. He was particularly driven by their unjustified exclusion from the banking sector. Yunus began by providing small loans to groups of women. He thought that the group feature made the loans easier to keep track of for the bank. Furthermore, groups could provide positive support and social pressure to smooth out behaviour patterns. In terms of

collection, he also experimented with very small and frequent repayment amounts, believing that lump sum repayments cause psychological hurdles for the borrowers. For a 365 taka loan (approximately $15 USD) he would require the borrower to simply pay back one taka every day (Yunus, 1998). Building on these principles of female inclusion, group lending, and small frequent payments, Grameen was formalized as an independent bank in 1983.

Around the same time, institutions in other countries were pioneering similar approaches for providing microcredit. In Indonesia, the microbanking division of Bank Rakyat Indonesia (BRI) underwent substantial reform in 1983. Aided by the government's major financial deregulation package, BRI was able to produce a large-scale commercially-sustainable microfinance system with unusual speed and success. By the end of the 1980s, both the Grameen Bank and BRI had demonstrated that microfinance institutions could reach over 1 million borrowers and maintain high repayment rates (Robinson, 2001). In Bolivia, BancoSol was established in 1992 to provide microfinance on a national scale (Rhyne, 2001). A substantial portion of BancoSol's funding was from international investment firms, further sparking global interest. There were differences in approaches taken by such pioneering organizations, but the common thread was an interest in developing financial methods to reach the poor without subsidy. Organizations were designing new financial products based on group and individual loans, reassessing appropriate interest rates to cover operational costs, developing new management and information systems, and rethinking appropriate training and incentives for staff members. By the late 1990s, microfinance had transitioned from a collection of institutions to a rapidly growing industry (Robinson, 2001).

Accurately quantifying the growth of microfinance is a challenging task as many of the institutions are small and informal. However, several research organizations have made estimates of microfinance at the global scale. The largest primary-source collection of microfinance data is produced by the Microcredit Summit Campaign (MSC). Figure 2.1 provides the number of registered microfinance programs and their clients according to the MSC (Maes & Reed, 2012).[2]

Figure 2.1: Growth of Microfinance Programs and Clients



Data Source: State of the Microcredit Summit Campaign Report 2012

In 2010, the number of microfinance programs registering with the MSC was 3,652. These programs reported reaching a worldwide total of 205.3 million clients with a current loan. During the period from 1997 to 2010, the number of total microfinance clients reported to the MSC grew on average by 23 percent per year. A more

[2] For alternative estimates see CGAP (www.cgap.org) or Microfinance Information Exchange (www.mixmarket.org). Also note that the Microcredit Summit data includes growth based on existing programs registering for the first time, so may inflate year over year growth. For further detail on the Microcredit Summit data see: www.microcreditsummit.org

conservative estimate of microfinance growth over the period from 1998 to 2004 was produced by Consultative Group to Assist the Poor (CGAP) by accounting for pre-existing institutions that started reporting to the MSC for the first time. This resulted in a growth estimate of 12 percent per year (Gonzalez & Rosenberg, 2006). For a systematic analysis on the role of social networks in the diffusion of microfinance, see the extensive study by Banerjee et al (2013).

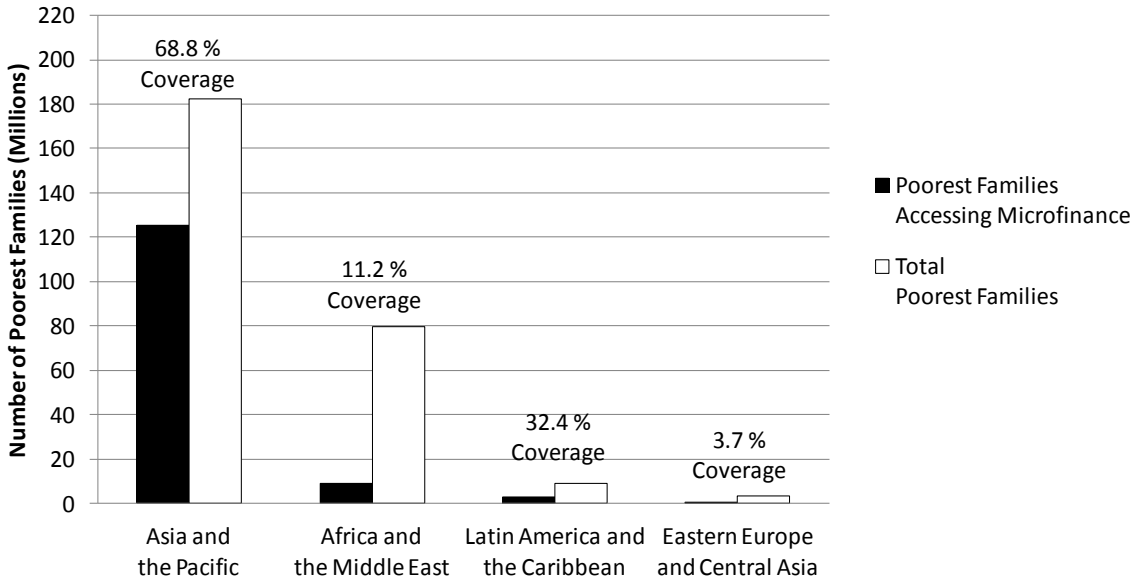
2.5 The Current Microfinance Landscape

Given the continued growth of the industry, what does the landscape of microfinance providers look like today? The landscape is populated by a diverse set of institutions. To name just a few dimensions, organizations vary considerably in terms of mission, targeted clients, product offering, and funding sources. As more varied actors continue to enter the microfinance space, what qualifies as a microfinance provider is becoming increasingly blurred (Helms, 2006). In this section, an overview of the landscape of microfinance is provided by examining three basic dimensions: (1) geographic coverage, (2) institution size, and (3) institution type.

Figure 2.2 summarizes the geographic coverage of microfinance based on the number of 'poorest' families reached in 2010. 'Poorest' refers to those living on less than $1.25 USD a day adjusted for purchasing power parity (Maes & Reed, 2012). The figure provides an estimate of percentage coverage for each geographic region by comparing the number of poorest families accessing microfinance to the total number of poorest families. Microfinance in Asia and the Pacific is the most extensive both in terms of the absolute number of clients and in terms of the percentage of the relevant population that

has been reached (68.8 percent coverage).[3] Since the 1980s, as was described with Grameen Bank and BRI, many of the pioneering institutions of microfinance have been located in Asia.

Figure 2.2: Geographic Coverage of Microfinance



Data Source: The World Bank and State of the Microcredit Summit Campaign Report 2012

A second key dimension of the microfinance landscape is the size of institutions. Currently, a small number of large organizations account for the majority of clients, producing a fairly concentrated market structure. See Table 2.1 for a breakdown of the market structure based on MSC data. Of the 3,652 microfinance organizations that registered with the MSC in 2010, the largest 21 organizations provided loans to over 75 percent of the total poorest clients worldwide. In contrast, there were thousands of

[3] It is known that some clients have outstanding loans at multiple organizations. This results in some amount of overestimation of the number of microfinance clients and the coverage percentage. However, based on individual MFI data it is currently not possible to accurately gauge the overlap of borrowers (Gonzalez, 2008).

small organizations that each served fewer than 2,500 clients and accounted for only 1.1 percent of the global market.

Table 2.1: Microfinance Market Structure by Institution Size

Institution Size - Type	**Number of Institutions**	**Combined Number of Clients**	**Percentage of Total**
Networks	8	65,105,273	47.3%
1 million or more	13	40,267,670	29.3%
1000,000 - 999,999	64	17,095,196	12.4%
10,000 - 99,999	361	10,877,810	7.9%
2,500 - 9,999	558	2,731,044	2.0%
Fewer than 2,500	2,648	1,470,448	1.1%
Total	3,652	137,547,441	100.0%

Note: Numbers refer to poorest clients below the $1.25 USD a day threshold. Data Source: State of the Microcredit Summit Campaign Report 2012.

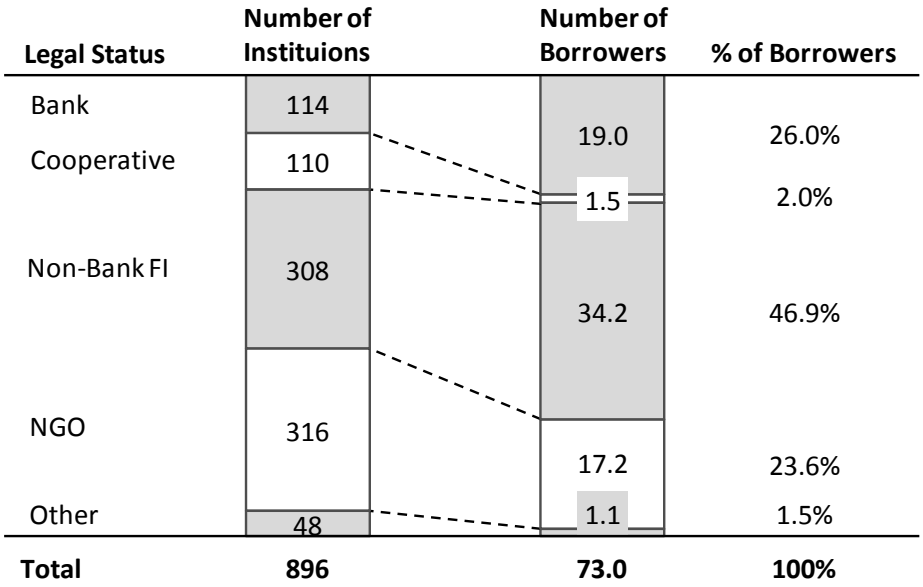
Finally, what does the current landscape look like in terms of institution type? The Microfinance Information Exchange (MIX) provides the most complete public source of this type of information with 896 institutions reporting in 2011. Here the institutions are divided into five categories based on legal status:

- **Bank**: a licensed financial intermediary regulated by a state banking supervisory agency
- **Cooperative - Credit Union**: a non-profit, member-based financial intermediary

- **Non-Bank Financial Institution**: this category is often created specifically for microfinance composed of financial intermediaries that provide similar services to those of a bank, but may have lower capital requirements or restricted service offerings
- **Non-Government Organization**: an organization registered as a non-profit, typically not regulated by a banking supervisory agency
- **Other**

Figure 2.3 provides the market structure in terms of the legal status of microfinance institutions in 2011. NGOs are the most common institution type although they are relatively small and account for only 23.6 percent of the borrowers. Historically, NGOs accounted for a larger share of the microfinance market. Currently, the increasing commercialization of the field is expanding the presence of banks and non-bank financial institutions. It can be argued that these different institution types are serving different segments of the microfinance market. An analysis by Cull et al (2009) found that NGOs typically have a stronger focus on social objectives. NGOs tended to provide the smallest loans, target the greatest number of women, and reach the poorest clients. The arguments for and against commercial funding are discussed in greater depth later in this chapter.

Figure 2.3: Microfinance Market Structure by Institution Type



Note: Borrowers in millions; Data Source: MIX Market 2011[4]

2.6 Critical Features of Microfinance

So far in this chapter, an overview of microfinance terminology, historical growth, and current landscape has been provided. With that background, the focus now shifts to three central debates in microfinance. Focusing on unresolved debates is useful for understanding a field currently in flux. The topics highlight alternative views regarding what has worked to date and potential future directions for microfinance.

The first debated topic concerns the critical features of microfinance. The global growth and consistently high repayment rates of microcredit suggest that the approach is working *de facto*. However, microfinance pioneers often innovated along multiple dimensions simultaneously. This produces a situation in which it is difficult to disentangle the factors producing the success. Understanding the underlying mechanisms

[4] The criteria used to define what qualifies as a microfinance provider can produce different characterizations of market structure. For an alternative view, see Helms (2006).

is particularly important when attempting to replicate the model in different cultural contexts. It remains an open question as to which features of microcredit are necessary, as well as how additional services and products should be incorporated in the microfinance offering. Here the debate around five features of microfinance is summarized: (1) group versus individual lending, (2) necessity of public repayment, (3) optimal repayment frequency, (4) impact of dynamic incentives, and (5) breadth of product-service offering.

2.6.1 Group Versus Individual Lending

One of the most discussed features of microfinance is the use of joint-liability group lending. Instead of offering loans to individual clients, microfinance institutions often offer loans to groups of clients, such that if a borrower defaults, the other group members are held financially responsible. Organizations have used a variety of group sizes and structures. At one end of the spectrum, BancoSol provides loans to 'solidarity groups' as small as three borrowers. At the other extreme, 'village banking' models are based on groups of up to 50 borrowers. Such models were pioneered by the Foundation for International Community Assistance (FINCA). The Grameen Bank began with a nested structure between these two extremes: eight subgroups of five borrowers were linked as a 40-person group.

Why are group loans particularly relevant to the poor? The basic motivation is that financial institutions often lack information on potential clients, are unable to effectively enforce the loan, and have little collateral to seize if a borrower defaults. These problems often make traditional lending in such markets financially unsustainable. Group lending seems to overcome some of these challenges by leveraging the social relationships of the group. Researchers have suggested that group members

are in a better position to screen, monitor, and enforce on each other (Ghatak, 1999; Stiglitz, 1990; Besley & Coate, 1995).

However, group lending has also been argued as placing too great a burden on borrowers. One issue is that group lending transfers some of the risk from the bank to the co-signers, even though the bank is often in a better position to bear the cost of a defaulting client (Stiglitz, 1990). A second concern is that group lending can produce substantial social costs for the borrowers as well. One can easily imagine how positive support to repay could turn into a harmful form of group pressure (Woolcock, 1999; Brett, 2006). Moreover, survey research indicates that when the question is posed to clients as to whether they would prefer a group loan or an individual loan, they strongly favour not being held jointly liable (Ditcher & Harper, 2007; Murray & Lynch, 2003).

Do the benefits of group lending outweigh the additional costs for the borrowers? A first step towards answering that question is understanding the impact on a microfinance institution's efficiency if it were to offer individual loans instead of group loans. If the operational benefits from group lending are minimal, a strong case can be made that the social costs of group lending outweigh the marginal economic benefits. Studies that directly address this issue have only been conducted recently and have produced mixed findings. Giné and Karlan (2007) conducted an experiment in the Philippines in which the existing clients of a rural bank were assigned either to continue on with joint-liability contracts or to switch to individual lending contracts. They found no effect of switching on repayment rates, suggesting that individual lending can be as effective as group lending. However, this study leaves open the possibility that the finding was a result of all clients having been previously selected for and accustomed to receiving group loans.

A recent experiment by Attanasio et al (2012) in Mongolia also found no difference in repayment rates, although other positive effects of group lending were noted. In their study, different villages were randomly assigned to receive access to group loans, individual loans, or no access. While they did not find a difference in default rates based on contract type, they did find that group lending produced an additional positive impact for the borrowers in terms of business creation and poverty alleviation. Attanasio et al argue that group lending ensures greater discipline in borrower behaviour, notably better project selection, and long-term execution. A recent study conducted in Sierra Leone by Sabin and Reed-Tsochas (2014) found that variation in a microcredit group's social structure has a significant effect on its economic performance. The study shows that group features, such as average spatial density and fragmentation, help us to understand why groups behave differently in terms of repayment.

To date, it is still unclear how crucial group lending is to microfinance. However, a general trend in the field is a shift away from joint-liability contracts. Armendáriz & Morduch (2000) suggest that while group lending may be relevant in some situations, it is time to focus on other mechanisms that may be more important to microfinance and less socially costly.

2.6.2 Public Repayment

One such alternative mechanism for microcredit is public repayments. Repayment in front of fellow community members leverages a social incentive without the full joint-liability contract. Research has found that the borrower's motivation to avoid embarrassment and social stigma can improve repayment rates (Rahman, 1999). Furthermore, public meetings can offer additional opportunities for training borrowers.

Often viewed as an innovator in the field, Grameen Bank revised its group lending approach in 2001. As part of the approach, Grameen no longer requires joint-liability loans but still administers loan collection in large public groups (Yunus, 2003). The importance of public repayment is also well illustrated by the practical example of recent innovations in mobile phone banking. See the M-Pesa and Group Lending vignette for a more detailed account.

Vignette: M-Pesa and Group Lending

In 2007, Safaricom-Vodafone launched a new mobile banking platform in Kenya called M-Pesa. The platform allowed clients to transfer money via their mobile phones. Within four years, M-Pesa had been adopted by over 14 million customers and over 70 percent of households in Kenya. The service was not restricted to microfinance clients (Suria, Jack, & Stokera, 2012).

M-Pesa actually started as a pilot program in 2005 to facilitate the loan disbursements and repayments of a microfinance institution called Faulu Kenya (Kumar, McKay, & Rotman, 2010). During the six month pilot, Faulu realized that if borrowers could make their payments using their mobile phones, public meetings to collect payments were not necessary. However, the management and staff at Faulu were concerned that without these public meetings, group cohesion - a key component of their lending model - would deteriorate. Following the pilot, Faulu decided not to use M-Pesa for loan repayments.

Other MFIs have come up with a hybrid approach that integrates M-Pesa with public meetings. The Small and Micro Enterprise Programme have pioneered an approach in which borrowers can make their payments via M-Pesa before group meetings, but attendance at the meetings is still required. This results in less meeting

time spent on cash collection and leaves more time for discussion of business problems and financial education. Such an approach integrates the latest banking technology with the well-known benefits of public meetings for group cohesion.

2.6.3 Repayment Frequency

Another questioned aspect of microfinance is the appropriate frequency of loan repayment. The basic tension arises because more frequent repayments typically produce better loan performance but are more operationally costly. If payments are not frequent enough, borrowers are faced with the challenges of repaying a larger lump sum. Repaying a lump sum is difficult for practical reasons, e.g. borrowers often do not have savings accounts, as well as for psychological reasons, e.g. there is greater temptation to prematurely spend the money on consumption needs (Fischer & Ghatak, 2011). Furthermore, Rai and Sjostrom (2004) argue that frequent payments produce more opportunities to gain information on the status of borrowers' projects. This offers the lender greater insight into whether a defaulting borrower is truly unable to pay, or is simply unwilling to pay. Analyzing empirical data, Silwal (2003) found that greater frequency of repayment is correlated with lower delinquency rates. Loans structured as weekly payments resulted in an 11 percent delinquency rate whereas loans structured as monthly repayments resulted in a 20 percent default rate.

However, if payments are scheduled too frequently an unnecessary cost is placed both on the lender and the borrower in terms of time and resources. Grameen Bank initially experimented with daily payments, expecting these to be the easiest for borrowers to make. However, Yunus found that daily payment was logistically burdensome and eventually switched to weekly payment (Yunus, 1998). Lenders

worldwide are still experimenting with credit products to achieve the right level of repayment frequency for their specific cultural context and the needs of their borrowers.

2.6.4 Dynamic Incentives

Another feature that is often attributed to the success of microcredit is the use of 'dynamic incentives' or 'progressive lending' (Hulme & Mosley, 1996). This practice refers to a lender offering a progression of increasing loan amounts to the borrower. For example a progression of four six-month loans might proceed in the amounts of $100, $125, $150, and $200. With dynamic incentives, relatively quick access to a greater amount of capital can serve as a strong incentive to pay back the current loan (Tedeschi, 2006).

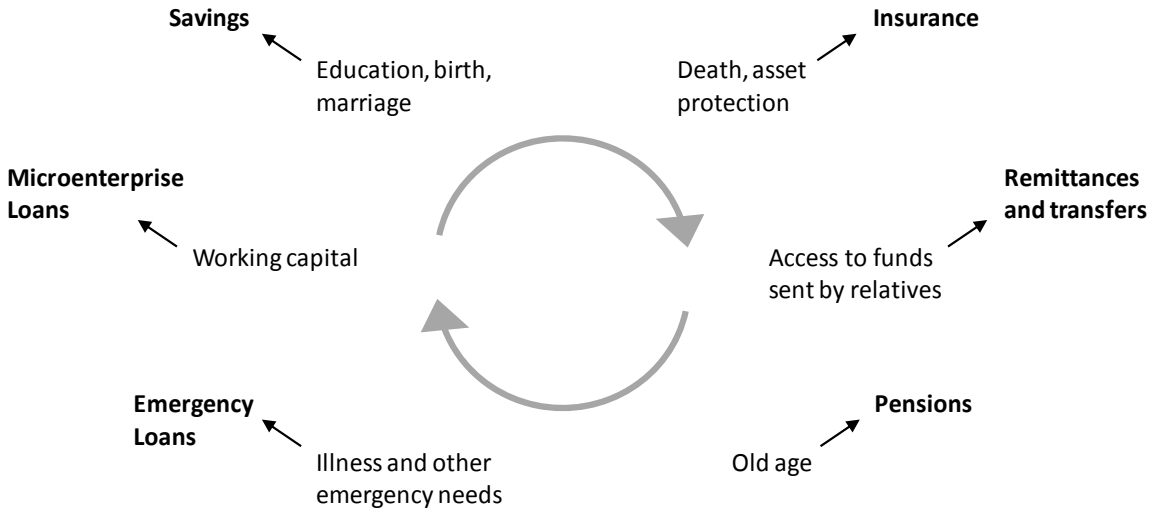
Programs based on dynamic incentives make it clear to the clients from the outset that the way they perform on their current loan directly affects the amount they can qualify for on the next loan. In the case of default, access to all future loans is typically cut off. This method has been used by microcredit providers of both individual and group loans. In group loan situations, if one member defaults and the other group members are not willing to repay, all the members lose access to future loans. Morduch (1999) notes that dynamic incentives may not produce an effective repayment mechanism if borrowers have easy access to loans from other organizations. For example, if a borrower can default on a loan and subsequently receive a loan from a different organization that does not know his or her repayment history, there is less incentive to repay the current loan. This suggests that without credit bureaus that can link repayment history across multiple lenders, the impact of dynamic incentives will decrease as the microfinance industry matures. An increase in the saturation of

microcredit providers will make it easier for borrowers to strategically default and take another loan elsewhere.

2.6.5 Breadth of Product-Service Offering

So far in this section the debated features of microfinance have focused on microcredit. This is reflective of the industry's historical focus on credit. However, during the 1990s a shift in terminology began in which 'microfinance' replaced 'microcredit' as the standard industry descriptor (Helms, 2006). This shift was spurred on by an understanding that the poor needed access to a fuller set of financial products. See Figure 2.4 for an overview of additional microfinance products. Though most microfinance providers are still credit-focused, today we see a greater number of providers offering a combination of credit, savings, insurance, money transfers, and 'plus' services. Pro Mujer, based in Latin America, offers a clear example of the 'microfinance plus' model. In addition to providing microcredit, Pro Mujer offers business training and healthcare support for women.

Figure 2.4: Need for Broader Range of Microfinance Products and Services



Source: CGAP 2006

Why has attention only recently broadened to a fuller set of financial products for the poor? In the case of microsavings, proponents have argued for its relevance for decades, referring to it as the "forgotten half of rural finance" (Vogel, 1984; Gonzalez-Vega, 1994). Microsavings can serve the dual purpose of providing the financial institution with an additional source of capital and offering clients a product that is critically needed. Resistance to offering savings is often driven by the perceived difficulty of administering small deposit accounts in developing countries. Financial institutions often expect such accounts will be unprofitable (Robinson, 2001). While there has been a realization that there is significant demand for complementary products such as savings and insurance, as yet there have been no breakthrough innovations on the supply side of these products in the same way that the industry experienced breakthroughs regarding the implementation of the microcredit model (Armendáriz & Morduch, 2010).

2.7 The Commercialization of Microfinance

The second core debate of this chapter concerns the appropriate role of commercialization in microfinance. It is useful to clarify at the outset what is typically meant by 'commercialization' in this discussion. As most microfinance providers use market-based principles to reach their objectives, the polarizing issue is not so much an issue of organizational design, but rather the use of commercial capital, i.e. funding with a profit motive. Opponents of commercialization argue that expectations of generating profits for investors will necessarily result in mission drift and ultimately harm the poor (see for example, Yunus, 2011; Bateman, 2010). In contrast, proponents of commercial funding view it as a positive and much-needed source of capital, not incompatible with the social focus of microfinance. They argue that earning profits will attract more capital to the industry and enable institutions to better meet the global demand for microfinance (see e.g. Akula, 2010; Rangan, Chu, & Petkoski, 2011). Armendáriz and Morduch (2010, 10) describe that "[i]f there is one unresolved tension that animates those who spend their days working on microfinance, it entails how to navigate the trade-offs between maximizing social impact and building strong, large financial institutions. It is a healthy tension, but an inescapable one."

In 2004, C.K. Prahalad's conception of 'The Fortune at the Bottom of the Pyramid' brought further attention to the idea that profits could be made while alleviating global poverty. The microfinance industry has leveraged commercial funding through debt for a considerable time. Much more recently, the industry has begun to be seen as an appropriate place for equity investments, private and public. To date, four microfinance institutions have made initial public offerings (IPOs) on stock exchanges: Bank Rakyat Indonesia (2003), Equity Bank in Kenya (2006), Banco Compartamos in

Mexico (2007), and Swayam Krishi Sangam (SKS) in India (2010). The two latter IPOs, both approximately 13 times oversubscribed (CGAP 2007; Shevock, 2010), generated a significant amount of public controversy with critics claiming the organizations were unnecessarily profiting from the poor. These IPOs have received the bulk of attention, both positive and negative, because of their public nature. However, a significant amount of equity has also been invested in microfinance through private placements (Glisovic et al, 2012). Table 2.2 summarizes the recent growth of private equity transactions both in number and value. Those in support of increased commercial interest in microfinance see these trends as a natural progression. Michael Chu, former president of Accion, argues that worldwide demand for microfinance cannot be met unless private, profit-oriented capital is drawn in. Increased competition will eventually help bring interest rates and profits down to consumer-friendly levels (Rosenberg, 2008).

Table 2.2: Historical Private Equity Transactions in Microfinance

Year	**Transactions** (number)	**Value** ($US million)
2005	28	106
2006	37	20
2007	37	60
2008	63	144
2009	32	230
2010	37	205
2011	68	292
Total	**302**	**1057**

Note: CGAP-JPMorgan estimates that this sample covers 70-80 percent of microfinance PE activity. Data Source: CGAP Research, Global Microfinance Equity Survey 2012

What is the argument against the commercialization of microfinance? Muhammad Yunus offers one of the clearest views as to why increased commercialization is the wrong direction for microfinance. He argues that expectations attached to commercial funding cause microfinance providers to act as a new "breed of loan sharks" (Yunus, 2011, A23). It is argued that commercially funded institutions will need to raise interest rates and engage in aggressive loan collection to satisfy profit-oriented shareholders. The demands of ever-increasing profits will cause a shift in the mission of microfinance that ultimately defeats the purpose of improving the lives of the poor.

For those sharing Yunus' views, the IPO of Banco Compartamos was a striking example of his concerns. Leading up to the IPO, Compartamos was charging an average annual interest rate of approximately 100 percent to its clients (CGAP, 2007). During the

IPO, the owners of Compartamos sold 30 percent of their stock for a total of $458 million USD. Critics claim that such interest rates and profits cannot be morally justified. Yunus argues that an additional downside of such transactions is that they further burden the poor with financial risk. Instead of creating funds based primarily on local deposits, organizations pursuing IPOs are accessing capital from volatile global markets and then transmitting this volatility to poor borrowers who are ill-equipped to mitigate the risk (Yunus, 2011).

A view between the extremes on the commercialization debate starts with the perspective that commercial funding will inevitably increase. The primary concern then becomes how it can best be integrated into the industry. There have been multiple occurences of commercial funding causing microfinance markets to overheat. For example, in Bolivia during the 1990s there was an influx of commercial funding and the market became so oversaturated that default rates soared and the market nearly collapsed (Rhyne, 2001). In more recent years, the microfinance market in India has struggled with instability. See the vignette on 'The Crisis in Andhra Pradesh' for more details. However, some empirical analysis has suggested that high growth of microfinance insitutions is not inherently detrimental to portfolio quality, except in the most extreme situations (Gonzalez, 2010). Portfolio deterioration can be mitigated if providers focus on growing *expansively* instead of *locally*. By looking to less developed geographic markets, the risk of creating a locally saturated market can be reduced.

Another reason why commercial and non-profit funding may constructively coexist in the industry is that these sources of funding tend to focus on different social objectives and market niches. Commercial microfinance banks are more likely to involve individual lending, make larger loans, and target fewer of the neediest clients (Cull et al, 2009). Nongovernmental microfinance organizations are more likely to

involve group lending, make smaller loans, and actively target more of the neediest clients (*ibid*). Furthermore, even though the microfinance industry is populated by a diversity of institutions of different sizes and types as described in a previous section of this chapter, commercial funding raised through IPOs and private equity investments to date has concentrated on the larger, more established microfinance institutions (Glisovic et al, 2012). This suggests that while multiple sources of funding are entering the microfinance industry, they are often directed towards organizations with different and potentially complementary objectives.

Vignette: The Crisis in Andhra Pradesh

A microfinance market to recently struggle with oversaturation is the state of Andhra Pradesh in India. The Indian market has been one of the strongest areas of microfinance growth over the last five years, accounting for over 65 percent of client growth worldwide (Maes & Reed, 2012). Andhra Pradesh was home to four of the largest Microfinance Institutions (MFIs) in India and many state-supported self-help groups (SHGs) providing similar microfinance services. Combined, the MFIs and SHGs were reaching over 23 million clients in Andhra Pradesh as of 2010. In July of that year, the explosive growth of the market was exemplified by the initial public offering (IPO) of India's largest MFI, SKS Microfinance. The IPO rasied over $155 million USD and made substantial profits for its shareholders.

However, Andhra Pradesh was headed for crisis. Microfinance clients in the area were highly over-indebted, with upwards of 80 percent of clients responsible for loans from multiple MFIs. Most of the MFIs did not have guidelines in place to gauge a client's level of indebtedness. The breaking point of the crisis occurred in late 2010 when allegations were reported of suicides resulting from the coercive collection practices of

MFIs. This ignited a political debate in which some political figures urged MFI clients not to repay their existing loans. The loan recovery rate dropped below 10 percent. Many MFIs were unable to continue their operations and the microfinance sector in Andhra Pradesh was almost wiped out.

Some describe the crisis in Andhra Pradesh as a primarily political issue. Others see it as a case of overaggressive growth fuelled by the interests of commercial profits. As of 2012, legislators in India were working on passing regulation aimed at stabilizing the market and preventing such occurrences in the future. This vignette draws primarily on material provided in Maes and Reed (2012) and CGAP (2010).

2.8 The Impact of Microfinance

The third debate concerns the actual impact of microfinance. In recent years, there has been increased attention placed on moving beyond the promise of microfinance towards rigorously assessing its effects. In general, research studies and the experience of practitioners suggest that microfinance can make a positive impact on its clients, but the magnitude of the impact is often less than expected and the manner in which it benefits the poor is often not as originally anticipated.

Given the strong growth and high repayment rates of microcredit, why is impact assessment a critical concern? First, the magnitude of the impact is important because investing in microfinance draws on financial and human resources that could be invested in other poverty alleviation activities. If the impact of microfinance is positive but weak, perhaps those resources could make a stronger impact on poverty alleviation if they were invested elsewhere, for example towards large, labour intensive enterprises in developing countries (see Karnani, 2007). Second, understanding impact is increasingly important as a broader range of investors enter the microfinance space. The

philanthropic Rockefeller Foundation in conjunction with J.P. Morgan have set a recent agenda focused on 'Impact Investing' (O'Donohoe et al, 2010). See the vignette 'Rockefeller Foundation and J.P. Morgan: Impact Investing Initiative' for more details. Such investors are often interested in measuring impact using a variety of performance indicators, both social and financial. Third, impact assessments will play a critical role in influencing the future of microfinance. Careful impact studies can provide insight into how the services need to evolve to better meet the needs of clients and the goals of the institutions.

Vignette: Rockefeller Foundation and J.P. Morgan: Impact Investing Initiative

'Impact Investing' captures the idea that investors can pursue financial returns while simultaneously addressing social and environmental problems (Bugg-Levine & Emerson, 2011). Investing for non-financial returns has a substantial history; however, an initiative was recently launched by the Rockefeller Foundation and J.P. Morgan aimed at defining and unifying this space. A report by the Monitor Institute on social and environmental investing found that the state of the market was fragmented, lacked widely accepted impact metrics, and had few platforms for intermediation (Freireich & Fulton, 2009). To begin addressing such challenges, the Rockefeller Foundation and J.P. Morgan produced 'Impact Investments: An Emerging Asset Class' (O'Donohoe et al, 2010), in which they attempted to clarify and size the potential market. They estimated that the market offered the potential over the following ten years for invested capital of $400 billion to $1 trillion USD.

How will the increasing momentum behind impact investing affect the microfinance field? Though not restricted to developing countries, impact investing targets the 'base of the pyramid,' defined by the World Resources Institute as people

earning less than $3,000 USD a year. The 2010 Impact Investments report (*ibid*) identified microfinance as one of the key sectors in which the initiative is to be targeted. Impact investors come in a variety of types, ranging from private foundations, such as the Esmée Fairbairn Foundation, to large-scale financial institutions, such as Citigroup. There is significant variation in the return expectations of such impact investors, with financial aims ranging from competitive to concessionary. This points to the importance of effectively matching the interests of investors to the social-financial mission of microfinance institutions. As the infrastructure for impact investing continues to develop, the interests of investors will increasingly fuel the demand for additional performance measures of microfinance institutions.

2.8.1 Challenges of Impact Assessment

The fundamental question driving microfinance impact assessments is typically some variant of "How are the lives of the participants different relative to how they would have been had the program not been implemented" (Karlan & Goldberg, 2011, 17). However, reaching an informative answer to this question is challenging for several reasons. First, accurately gauging how the lives of clients might have changed even if they were not involved in microfinance can be difficult. During a study period, clients not involved in microfinance may also experience some improvement in their financial situation due to other factors, for example the macroeconomic environment in the country may have improved or there may have been increased investment in surrounding infrastructure. In order to accurately determine what amount of impact should be attributed to involvement in microfinance versus other such factors, it is necessary to have a valid measurement of the counterfactual, i.e. how lives would have been had the program not been implemented (Karlan & Goldberg, 2011). Gauging the counterfactual

is usually accomplished by comparing the change experienced by those involved in microfinance to the change experienced by those not involved.

This comparison raises a second basic challenge of microfinance impact studies: selection bias. Often the individuals that want to be involved in microfinance programs differ systematically from those that do not choose to become involved. For example, those that choose to get involved in microfinance may already have stronger businesses and feel more confident that they will be able to repay a loan (Hashemi, 1997). A simple comparison of microfinance participants to non-participants may significantly overinflate the effect of microfinance involvement by not accounting for this selection bias.

A third assessment challenge particularly relevant to microfinance is the need to account for individuals that drop out of the programs (Armendáriz & Morduch, 2010). For example, under group lending contracts a borrower is often removed from the group for poor performance. In such a case, microfinance may have had a negative effect on the removed client's life, but he or she often drops out of the assessment which leads to an overestimate of impact.

Finally, defining the measures of impact is a challenging task because effects of microfinance may reach into many dimensions of a client's life. The most common measures of microfinance impact are related to enterprise income and household consumption (Karlan & Goldberg, 2011). However, there is wider interest in other social impact measures as well, such as consumption smoothing, healthcare, education, and female empowerment (Armendáriz & Morduch, 2010). Understanding the interaction of these different measures is important because they can often be interrelated, e.g. an increase in one measure causes a drop in another (Karlan & Goldberg, 2011).

The challenges of assessment mentioned here are not minor concerns. If such issues are not appropriately addressed, they can affect the results of impact measurements by up to 100 percent or even reverse conclusions (Armendáriz & Morduch, 2010).

2.8.2 Results of Randomized Controlled Trials

To overcome the challenges of impact measurement, there has been increased attention in microfinance placed on the use of Randomized Controlled Trials (RCTs) (Bauchet et al, 2011). An RCT mitigates many of the challenges listed above by comparing the effects of a treatment group (e.g. those that receive access to microfinance services) to a control group (e.g. those not offered access to microfinance). By drawing on a large enough sample and randomly determining the groups that are designated as treatment and control, the groups serving as a control population are expected to have on average the same basic characteristics of the treatment population and provide a clean estimate of the counterfactual (Karlan & Goldberg, 2011). While the RCT method poses several benefits for research, it is useful to keep in mind that it can raise important ethical issues by selectively offering access to some potential clients and not others, who may be equally in need.

To date there have been three RCT studies on the effects of access to microcredit that have received the most attention. Banerjee et al (2010) studied the effect of offering access to microcredit in randomly selected slums in Hyderabad, India. Crépon et al (2011) conducted a similar study providing access to selected rural villages in Morocco. Karlan and Zinman (2011) studied the effects of offering microcredit to individuals in a peri-urban setting in the Philippines. In what ways did these studies produce similar and differing results?

Generally, the studies suggest that access to microcredit can have a modest, positive impact on the financial state of recipients, but often not in terms of direct impact as expected, e.g. business revenue. Banerjee et al (2010) found that recipients of microcredit access were 32 percent more likely to start a new business than those without access; but, they found no significant effect on business revenue or profits. However, the studies indicate that access to microcredit can improve the welfare of clients through promoting changes in their financial behaviour. Bauchet et al (2011) found that though microcredit did not change the *amount* households spent on average, it did affect *how* households spent based on their business activity. If recipients had started a new business or had owned a business prior to receiving credit access, they were more likely to reduce their spending on consumption goods and direct more money towards business investment and durable household goods (Banerjee et al, 2010; Crépon et al, 2011). However, if recipients did not have a prior business or did not start a new business, they were more likely to increase their spending on consumption goods (*ibid*). This suggests that when microcredit is accessed specifically by business owners, it can shift a household's expenditures towards usages that should improve their livelihoods in the long run. However, none of these studies found any significant impact on broader dimensions such as education, healthcare usage, employing more workers, or female empowerment (Banerjee et al, 2010; Crépon et al, 2011; Karlan & Zinman, 2011).

The interpretation of the results from the RCTs can be grouped into three perspectives. A first interpretation is that microfinance is failing to meet its lofty expectations (e.g. Bennett, 2009). Accordingly, one should consider funneling more resources to alternative approaches for poverty alleviation. A second interpretation argues that excessive weight should not be placed on such a small number of studies (e.g. Maes & Reed, 2012). Overgeneralizing these studies may be particularly risky

because the cultural context of microfinance programs has been found to strongly affect their success (Ahlin, Lin & Maio, 2011). Also, these impact studies have all been relatively short term, between 11 and 24 months, and it is conceivable that the more significant effects of microfinance take longer to occur.

A third interpretation of the recent evaluation studies considers that though microfinance may not be revolutionizing microbusinesses as expected, it is positively impacting poor households in a variety of unanticipated ways (Morduch, 2011). There is a growing body of evidence, drawing both on formal evaluation studies and other forms of descriptive research (e.g. Collins et al, 2009), that suggests the real impact of microfinance is not its effect on microbusinesses, but rather on managing tight cashflows in poor households. The studies suggest that microcredit is more often used to cope with financial risk (e.g. pay for funeral expenses), to make household investments, or to pay for food, medical bills, and school fees (Morduch, 2011; Bauchet et al, 2011; Karlan & Zinman, 2011). Microcredit recipients are adapting the product to suit their own needs. Often business growth is not the most pressing issue.

Such evidence lends further credence to the idea that the basic microfinance model should move beyond credit to involve a broader range of products. Though the findings are still preliminary, new impact evaluations focusing on other microfinance products, such as savings and insurance, have found much stronger, positive effects on the lives of clients (Bauchet et al, 2011). A study by Dupas and Robinson (2011) on microsavings in Kenya found that there was strong demand and usage of savings accounts. Women who recieved access to savings accounts increased their business investment, had more money available to purchase food for their households, and were better able to deal with health shocks as compared to those in the control groups.

A recent evaluation of microinsurance for farmers in Ghana also found positive effects on household welfare, with members of the households that received access less likely to go without meals (Karlan, Osei-Akoto, Osei & Udry, Forthcoming). These studies suggest that though the rhetoric of microfinance has almost exclusively focused on the mechanism of microenterprise growth, there are substantial opportunities for improving welfare through products focused on cashflow management and risk mitigation (Bauchet et al, 2011).

2.9 Implications for Social Finance

Over the last four decades, the pioneers of modern microfinance have wrestled with developing an effective means for extending financial access to the poor. The evolution from a handful of organizations to a worldwide industry has been shaped both by innovative advances as well as unfortunate missteps. What implications can be drawn from the experience of microfinance for social finance more broadly? Three implications present themselves based on the content reviewed in this chapter.

First, the history of microfinance suggests that the details of the financial model and product features are not minor concerns, but are at the core of the movement's success. Microcredit did not dramatically expand over the last several decades simply because there was demand for credit access and an available supply of capital. The generally unsuccessful attempts of government-subsidized credit programs for the rural poor from the 1950s to the 1980s demonstrated that good intentions and available funding are not enough. Rather, a key differentiator of modern microfinance was the early demonstration of a model for credit that was financially sustainable and scalable (Cull et al, 2009). Seemingly subtle innovations such as group lending, frequent repayment, and dynamic incentives were at the heart of the new movement. For the

broader field of social finance, this suggests that the details of the financial products and services will play a central role in determining success or failure. As illustrated by the growing interest in impact investing, it is likely that the available capital for social investment will continue to increase dramatically over the next decade (O'Donohoe et al, 2010). The challenge lies in developing innovative products and delivery systems uniquely suited to their objectives, rather than relying on loose-fit adaptations of pre-existing models.

Second, several missteps of the microfinance movement offer a cautionary word against extreme growth fuelled by commercial funding. In various markets, such as in Bolivia during the 1990s and India during the late 2000s, institutions leveraging commercial funding contributed to the markets' dramatic increase in scale. However, these markets also became so quickly saturated that they reached crisis points and nearly collapsed (Rhyne, 2001; CGAP, 2010). Social finance is particularly at risk of excessive growth because it often targets markets that are urgently in need of social change. Often these markets are less developed and lack significant infrastructure to mitigate system-wide risk. In the example of microfinance, Bolivia and India lacked independent credit bureaus for tracking a client's individual level of indebtedness across institutions. In such markets, it is easier for unrestrained growth to result in collapses that ultimately harm the intended beneficiaries of social finance.

Third, as the public awareness of microfinance has grown, impact assessment has played different roles. Early on, the story and promise of microfinance played a primary role in building global awareness. Once the microfinance model gained international attention, controlled studies have played an increasingly important role. Furthermore, the case of microfinance suggests that quality evaluation studies can do more than gauge impact. Rather, evaluation studies can also be effectively used to shed light on the

specific deficiencies of a program and how they should be revised. For microfinance, a combination of practitioner experience, qualitative research, and evaluation studies has reinforced the idea that the basic microcredit product for enterprise growth has not been meeting the most pressing financial needs of the poor (Morduch, 2011). Clients were using products in unanticipated ways to suit their own needs for cash flow management and risk reduction, suggesting that further advances in microsavings and microinsurance are needed. For social finance more broadly, this indicates that there may be substantial benefits in viewing impact studies as more than straight-forward assessments of program success or failure. A nuanced understanding of why a program does not work as expected can in itself reveal alternative paths forward.

2.10 Conclusion

This review of the development and current state of microfinance illustrates the rapid change occurring in the industry. The field is in flux along several dimensions. Access to new commercial sources of funding are shifting the market structure. The landscape of microfinance institutions is becoming increasingly diverse in terms of organizational design and mission. Some microfinance markets have overheated in recent years, highlighting the risk of markets becoming oversaturated. Rigorous impact assessments are raising new questions about what microfinance can actually achieve. This is causing many to rethink how the standard microfinance product-service offering should evolve to better suit the financial needs of the poor.

Muhammad Yunus goes so far as to say that some of the new commercial institutions entering the industry should not be allowed to leverage the term 'microcredit' with their business models (Yunus, 2011). He argues that the term has been built up over the preceding decades to connote a certain level of commitment to social objectives, a

way of dealing with the poor based on trust and respect, and that the term can now be easily used to misrepresent an organization's business activities. Whether one endorses or eschews Yunus' view, it is true that microfinance is increasingly a diverse space and distinguishing organizational objectives is not obvious. This tension exemplifies the flux occurring in the field and highlights the need for an awareness of the diversity of models that constitute modern microfinance.

3 Literature Review

3.1 Literature Overview

This section provides a condensed review of three bodies of literature relevant to this research. First, I begin with a review of the literature on group lending in microfinance. In contrast to the last chapter which provided a broader background on the history and current status of the microfinance field, this chapter focuses specifically on group lending research. This provides the empirical context of the research and critiques prior academic studies. I review the group lending literature in terms of theoretical perspectives, empirical evidence, and descriptive accounts. Throughout the review I draw on Granovetter's (1985) critique of under- and oversocialized views of economic action to highlight biases in the current body of work and motivate the proposed structural analysis of social collateral.

Second, I review literature related to social structure and economic action. This provides the theoretical foundation on which my research is built. Given the vastness of this field, I focus on three areas directly relevant to this research: social embeddedness, social capital, and social network analysis. At points these related topics overlap; together they argue for a socially embedded view of economic action and highlight critical considerations when attempting to apply such a perspective.

Finally, I review literature regarding experiments on social behaviour and economic cooperation. This area of research offers insight to the behavioural motivations and social mechanisms affecting economic cooperation. I draw on this body of work as a bridge between a microcredit group's social structure and its economic performance. Table 3.1 provides a summary of the literature review's structure and the rationale for each component.

Table 3.1: Literature Review Structure

Literature Review Sections	**Rationale**	**Review Framework**	**Key Works**
Group Lending	Empirical context of research	(1) Theoretical perspectives, (2) Empirical Evidence, (3) Descriptive Accounts	Stiglitz (1990), Besley & Coate (1995), Ghatak (1999), Karlan (2007)
Social Structure and Economic Action	Theoretical foundation for structural analysis	(1) Social Embeddedness, (2) Social Capital, (3) Social Network Analysis	Granovetter (1985), Coleman (1988), Burt (1992), Uzzi (1996)
Economic Cooperation Experiments	Highlights behavioural mechanisms	(1) Cooperation Games (2) Key Findings (3) Social Structure Context	Henrich et al (2004), Gintis et al (2005), Nowak et al (2005), Durlauf & Blume (2010)

3.2 Group Lending Literature

The public success of microfinance institutions over the last several decades has spurred a wide variety of literature on the topic (Brau & Woller, 2004). Research has broadly focused on issues such as economic development (Bose, 1998; Swain, 2006), financial sustainability of microfinance institutions (Von Pischke, 1996; Conning, 1999), and social impact (Pitt & Khandker, 1998; Mallick, 2002). However, I focus this review of microfinance on research related to group lending because of its central role in this study.

3.2.1 Theoretical Perspectives on Group Lending

During the 1990s several articles were published that established the theoretical foundation for group lending in microfinance. This theoretical work was motivated by the success of institutions, such as the Grameen Bank, in extending credit to populations

in developing countries that were previously viewed as unreachable. Three key mechanisms were proposed to explain this success: peer screening (Varian, 1990; Ghatak 1999), peer monitoring (Stiglitz, 1990), and peer enforcement (Besley & Coate, 1995). The value of group lending was framed in economic terms as overcoming two issues fundamental to any credit market: adverse selection and moral hazard (Stiglitz, 1990).[1] Given the importance of these three theoretical arguments to the microfinance literature, I summarize the key elements of each model before turning to a critique of their assumptions and implications.

The basic question that these economic models attempted to address was: *how is the use of group lending creating a new level of efficiency for banking institutions in developing economies?* First, the peer selection argument put forward by Varian (1990) and Ghatak (1999) suggests that a bank can overcome the adverse selection problem in developing economies by exploiting local information possessed by potential borrowers regarding their peers. By requiring borrowers to self-assemble into joint-liability groups, a natural screening process occurs such that safer borrowers tend to select safer partners because they will be held responsible if a group member defaults. Via this 'assortative matching' mechanism, the riskier borrowers are either screened out of the borrowing pool (Varian, 1990) or left to partner with other risky borrowers (Ghatak, 1999). As a result, the risky borrowers that remain in the borrowing pool bear a greater *effective* interest rate despite the bank charging the same nominal interest rate to all of its clients (*ibid).*

[1] In the context of microfinance, adverse selection refers to the situation faced by a lender unable to distinguish between risky and safe borrowers before a loan is offered (Armendáriz De Aghion & Gollier, 2000). Once the loan has been disbursed, moral hazard refers to the challenge of incentivizing a borrower to honour the contract and repay the loan (Hermes, Lensink & Mehrteab, 2005).

Second, whereas the peer screening argument overcomes adverse selection before the loan is offered, the peer monitoring theory put forth by Stiglitz (1990) addresses moral hazard after the loan has been disbursed. Having received the bank's money, a borrower may be motivated to invest in a risky project with a greater potential return. However, the bank prefers that the borrower invest in a safe project and simply repay the loan. Stiglitz notes that in developing economies it can be prohibitively expensive for the bank to monitor the borrower, i.e. ensure that the borrower is not using the loan for risky projects. Stiglitz argues that group lending poses a partial solution to this problem. The model assumes that a peer has greater access to local information regarding the riskiness of a neighbour's activities. By making borrowers jointly liable, a bank provides an incentive structure for borrowers to monitor each other. This transfers the cost of monitoring to the borrowers and allows the bank to charge a lower interest rate.

Third, the theoretical contribution by Besley and Coate (1995) also regards the problem of moral hazard, but addresses a different issue: loan enforcement. Whereas Stiglitz (1990) considers a borrower's *ability to pay*, Besley and Coate (1995) focus on a borrower's *willingness to pay*. Willingness becomes a critical issue once the borrower has realized the returns on the investment, but the bank has little ability to enforce repayment. As in the other models of group lending, the mechanism involves transferring the burden to the borrowers. Besley and Coate (1995) use a game-theoretic model to raise an interesting conundrum posed by group lending. They note that group lending, as compared to individual lending, can actually provide a disincentive for repayment because it allows for free-riders. Why would a borrower be more willing to repay a group contract when he or she can let the other group members bear the burden? Besley and Coate (1995) introduce the term 'social collateral' to answer this question.

They note that socially connected groups can enforce penalties on delinquent borrowers that banks cannot. Indeed, if the social punishment for defaulting is severe enough, Besley and Coate (1995) argue that group lending will necessarily yield higher repayment rates than individual lending.

In sum, these economic arguments put forth three mechanisms that demonstrate how group lending can theoretically increase the efficiency of a bank faced with adverse selection and moral hazard in developing economies. These seminal articles have been the theoretical foundation for much of the subsequent research on group lending (see e.g. Karlan, 2007; Armendáriz & Morduch, 2010; Cason, Gangadharan & Maitra, 2012). However, I argue that this perspective is representative of what Granovetter (1985) has described as an 'undersocialized' view of economic action. Despite the fact that the topic of interest is group lending, an inherently social process, these economic theories are based on models of atomistic agents acting solely in regard to their individual self-interests. For example, Ghatak (1999) assumes that borrowers are fully aware of their peers' risk profiles and form groups based on this information. Once in groups, Stiglitz (1990) suggests the interaction of interest between borrowers is a monitoring function motivated by self-interest. And when faced with a delinquent group member, Besley and Coate (1995) assume that the response will be a sanction driven by personal financial incentives.

While such motivations are certainly plausible, I argue that these assumptions may not be the best starting point for understanding group lending. Rather, a fruitful analysis of economic cooperation begins with the assumption that the actors are embedded in concrete personal relationships (Granovetter, 1985). These structures are not just conduits for self-interested information retrieval. Rather, the nature of the

personal relations plays a fundamental role in motivating differences in behaviour as basic as trust and malfeasance (*ibid*).

In contrast to the economic approaches, some research on group lending has been based on a more *socialized* set of assumptions. These works primarily focus on the role of social capital and trust (e.g. Sriram, 2005; Kanak and Iiguni, 2007). Such studies approach the topic of group lending with a greater emphasis on the central role of personal relationships. Perhaps the best attempt at providing a social capital framework for microfinance has been provided by Woolcock (2001). In this article he imports theoretical distinctions developed by Portes (1995) from the social capital literature. Woolcock (2001) suggests that the dual nature of social capital is based on its ability to both bond groups (via intra-group ties) and bridge groups (via inter-group networks).

However, the theoretical framework that Woolcock (2001) attempted to establish for microfinance failed to gain traction. In general, research on group lending and social capital suffers from a lack of consistent terminology and a clear operationalization of the concept. Even within the social capital literature itself, critics argue that the term has been weakened by its use as an umbrella concept (Adler & Kwon, 2002). This inconsistency is clearly apparent when the term is transported to the microfinance literature, as evidenced by social capital referring to concepts as varied as personal obligations facilitating the individual action of microentreprenuers (Gomez & Santor, 2001) to a community-level capacity for cooperation and mutual support in the fight against poverty (Quinones & Seibel, 2000). I suggest that such studies of group lending are typically under theorized, failing to clearly build on the growing literature on social structure and economic action.

3.2.2 Empirical Findings: Survey and Experimental Results

Having discussed the theoretical frameworks most frequently applied to group lending, I now turn to the empirical evidence. Though interest in empirical microfinance research has increased over the last two decades, it still lags substantially behind the theoretical work (Ghatak, 1999; Karlan, 2007). At a high level, microfinance appears to be succeeding with strong repayment rates and continued growth (Morduch, 1999). However, attempts at understanding the underlying mechanisms have produced inconsistent results (Hermes & Lensink, 2007). Two causes of these inconsistent findings are often cited as: (1) the practical difficulty of gathering empirical microfinance data in developing countries (Ditcher & Harper, 2007); and, (2) a problem more general to social science, the challenge of distinguishing between plausible interpretations of survey data (Gill & Johnson, 2002; Morduch, 1999). I would also add a third cause to the list: the limitations of the theoretical frameworks for group lending. As discussed previously, the theoretical frameworks are based predominantly on undersocialized assumptions, which deviate systematically from observed behaviour in other studies of economic cooperation (Gintis et al, 2005); or the theoretical frameworks are unclear, as in the inconsistent application of the social capital concept to group lending. Considering these three reasons together, it is not surprising that producing consistent interpretations of the empirical microfinance evidence is a challenging task.

Nonetheless, a number of empirical studies have explored the role of social connections in group lending: e.g. Wenner (1995), Wydick (1999), and Karlan (2007). A number of studies have produced findings that social cohesion improves performance: the number of common bonds within the group (Zeller, 1998), the social ties of the group leader (Hermes, Lensink & Mehrteab, 2006), and less average distance between

group members (Karlan, 2007) are all correlated with higher group repayment rates. However, other studies have found opposing results. For example, Wydick (1999) finds no significant effect of intra-group social ties on performance, Sharma and Zeller (1997) find that an increased number of relatives within a group actually harms performance, and Paxton et al (2000) find that greater homogeneity of social characteristics is correlated with worse group repayment. How can we explain such variation in empirical findings?

I argue that a key limitation of these analyses is their treatment of social relationships. Instead of considering the variation in personal connections that constitutes a group's social structure, they attempt to condense the structure down to a single amorphous measure of cohesiveness. For example, Wydick (1999) uses a binary measure of social cohesion based on the group's survey response regarding whether they were all friends before the group formed (1 = all friends, 0 = not all friends). Such an analysis oversimplifies social structure by not maintaining the different connections between individuals. This leads to the entanglement of multiple social mechanisms that may be affecting group performance in different ways.

Furthermore, it is interesting to note that some research that applies a more socialized interpretation is limited in a very similar way. For example, Anthony (2005) considers the role of group identity. She uses a survey technique to measure the borrowers' collective sense of belonging to the group (1-10 index), questioning whether this will enhance economic cooperation through greater norm compliance. However, as Granovetter (1985) points out, such an oversocialized view of human behaviour is ironically similar to the undersocialized view in that they are both devoid of the actual social structures that humans are embedded in. The econometric studies have used variables such as business similarity to represent the ability to monitor peers (Wydick,

1999), whereas an oversocialized view, such as that taken by Anthony (2005), measures social cohesion through a sense of group identity. Both attempt to remove individuals from their complex social structure and motivate their actions with a single incentive, respectively personal gain or group conformity (Granovetter, 1985).

Given the challenges that the current approaches have encountered in disentangling the mechanisms affecting group lending, there has been a recent interest in the use of experimental methods for microfinance research. For example, Abbink, Irlenbusch, and Renner (2006) focused on the role of social ties in a microfinance repayment game similar to the basic public goods game (see Durlauf & Blume, 2010). Abbink et al (2006) found that groups with social ties cooperated more in the early rounds of the game but were less stable in the long run. Cassar, Crowley, and Wydick (2007) focused instead on distinguishing between the different types of trust in group lending. They found that specific interpersonal trust is a stronger predictor of repayment than general societal trust.

The most extensive series of microfinance experiments to date has been conducted by Giné et al (2010). Establishing an experimental lab in Lima, Peru, Giné et al conducted eleven variants of a microfinance repayment game over a period of seven months to further disentangle various social mechanisms. A problem explored during the analysis was that joint-liability structure can actually induce suboptimal behaviour, e.g. by promoting excessive risk-taking and free-riding, as compared to individual lending. However, they found that allowing the groups to self-assemble counteracted these behaviours. It was found that groups did not self assemble based on risk profiles (as assumed by Ghatak, 1999), but rather assembled based on social relationships (e.g. having previously watched another participant's shop while they were away).

Surprisingly, Giné et al (2010) found that groups based on such social ties resulted in behaviour that was sub-optimally conservative instead of risky.

These experimental results provide valuable findings for conducting further non-experimental research. They offer insights into the nature of the mechanisms underlying group lending and suggest how a research design may be optimally shaped to capture the relevant mechanisms.

3.2.3 Descriptive Accounts: Ethnographic and Impact Studies

In this final substantive section of the microfinance literature review, I briefly summarize the relevance of descriptive accounts of group lending. There are a number of ethnographic and impact studies that are less concerned with analyzing microfinance through the lens of a theory, but rather in accurately characterizing the dynamics that occur within the groups. These studies are of particular value to this research because they offer first-hand accounts of the social processes occurring in group lending.

These descriptive accounts of group lending have also produced opposing findings. For example, Rankin (2002) notes the use of shaming and public loss of honour in motivating repayment, whereas Brett (2006) notes that group lending produces increased solidarity, laughter, and camaraderie among women, resulting in strong social and financial support. Woolcock (1999) describes the critical role of the loan officers and microfinance institution staff in ensuring that the group functions properly.

Montgomery (1996) notes that individuals often view defaulting on the group as a last resort; borrowers in times of crisis preferred to first borrow from kin, second from local money lenders at an extremely high rate, and only as a last resort considered burdening other group members. The consistent element across these descriptive accounts that is generally not discussed in the other studies I have reviewed is the sheer

difficulty of survival faced by many of the microcredit borrowers on a daily basis. These accounts provide an important context for considering what social behaviour one might expect to find in group lending.

3.2.4 Additional Forms of Group Lending: RoSCAs

Though the birth of the modern microfinance movement is often associated with the founding of Grameen Bank by Muhammad Yunus during the 1970s (Morduch, 1999), group lending in developing countries has a far longer history (Huppi & Feder, 1990). Most notably, group lending has historically taken on the form of Rotating Savings and Credit Associations, or RoSCAs (Geertz, 1962; Ardener, 1964), and has been widely referenced by scholars of collective action (Coleman, 1988; Granovetter, 1985; Portes & Sensenbrenner, 1993). My review of this related literature on rotating credit associations supplements the research on microfinance in two important ways. First, this review puts group lending in its proper historical perspective, highlighting its widespread usage and detailing how the modern microfinance movement is both similar to and different from previously existing models of group lending. Second, and more importantly, in contrast to the literature on microfinance being approached from a primarily undersocialized economic perspective, the literature on rotating credit associations has received significantly more attention from anthropologists and sociologists. I review this literature to make use of the additional insights that these perspectives have generated regarding the role of social structure in group lending.

Before proceeding with a discussion of the usage of RoSCAs, it is useful to define the key features that constitute this type of lending arrangement. Ardener (1964, 201) defines a rotating credit association as “an association formed upon a core of participants who agree to make regular contributions to a fund which is given, in whole

or in part, to each contributor in rotation." Geertz's (1962) description provides the simplest explanation of what this means in practice:

> *The basic principle upon which the rotating credit association is founded is everywhere the same: a lump sum fund composed of fixed contributions from each member of the association is distributed, at fixed intervals and as a whole, to each member of the association in turn. Thus, if there are ten members of the association, if the association meets weekly, and if the weekly contribution from each member is one dollar, then each week over a ten-week period a different member will receive ten dollars (Geertz, 1962, 243).*

This basic arrangement takes on a remarkably similar form over a wide geographical area. The RoSCA has been used extensively in Southeast Asia, India and Africa under a variety of names: contribution clubs, slates, mutual lending societies, and pooling clubs (*ibid*). Though the basic principle is the same, there are certainly cultural variations: size, ranging from ten to several hundred members; organizational form regarding membership roles; contribution type and amount; and ordering of payouts (Ardener, 1964).

Though both microfinance institutions and rotating credit associations utilize group lending, it is necessary to consider how they fundamentally differ. There are three basic differences: (1) source of capital; (2) organization formality; and, (3) roles of the group members. First, MFIs and RoSCAs differ in their source of capital. The RoSCA generates capital internally, i.e. from the very group members that will eventually access it in turn (Ardener, 1964). In contrast, MFIs typically mobilize capital from outside the area, from sources such as international donor agencies, development banks, or government organizations (Huppi & Feder, 1990; Matin, Hulme & Rutherford, 2002). Second, MFIs and RoSCAs differ in their organization formality. Typically, RoSCAs do not maintain professional staff; rather, the group members handle the administrative

responsibilities (Geertz, 1962; Ardener, 1964). In contrast to this informal structure, MFIs typically maintain professional staff specialized by function, e.g. loan officers, accountants, managers (Matin et al, 2002). Third, the financial role of the group member is different in RoSCAs from those in MFIs. When a borrower receives a portion of a group loan from an MFI, he or she is simply a recipient of credit (assuming no deposit was required). However, in a RoSCA, the first member to receive the lump sum is a debtor and the last to receive it is a creditor (Ardener, 1964). Thus, members of a RoSCA play the role of both creditors and debtors in varying degree, dependent on a member's rotation in the process (*ibid*). Taken together, these three differences between RoSCAs and MFIs suggest that RoSCAs are a more *organic* form of group lending, which may cause differences in group behaviour.

Having introduced the concept of RoSCAs, I now turn to the findings regarding social structure. Both economists (Besley et al, 1993) and anthropologists (Geertz, 1962; Ardener, 1964) have consistently noted that group lending plays both an economic and social role. Economically, the RoSCA provides credit and savings capacities to groups that are often excluded from the formal financial market (Besley et al, 1993). However, the group also serves a distinctly social function. Cooperative members often note that group lending strengthens communal harmony and stimulates neighbourly cooperation (Geertz, 1962). Members have suggested that this social function is even more important than the economic aspect (*ibid*). The social aspect is borne out in the regular meetings of cooperative members; typically, each member in turn hosts a gathering which includes a social dinner and lending meeting (Ardener, 1964).

As the RoSCA serves dual functions, researchers have found that the motivations affecting group cooperation are also a combination of economic and social elements (Geertz, 1962; Ardener, 1964). The low level of default is typically associated with the

strength of the social relationships. Geertz (1962) states that group members are all fairly close acquaintances and so would be deeply ashamed of evading their obligations. Similarly, Ardener (1964, 216) suggests that repayment to these groups is a matter of 'honour' or 'solemn duty.' However, both Geertz (1964) and Ardener (1962) do not go as far as to suggest that repayment is devoid of economic interest. Geertz (1964) summarizes his perspective:

> *Cooperation is founded on a very lively sense of the mutual value to the participants of such cooperation, not on a general ethic of the unity of all men or on an organic view of society which takes the group as primary and the individual as secondary (Geertz, 1964, 244).*

Framed in this way, Geertz is suggesting that the incentive for cooperation is very similar to reciprocity, rather than strict adherence to social norms or placement of the individual behind the good of the collective.

Besides insight to the borrower motivations, research on RoSCAs also offers evidence regarding the effect of social structure on group performance. In particular, it is interesting to note that in practice RoSCAs have strongly different views on the appropriate role of kin in group lending. Kin and other strong social ties serve as the foundation for social cohesion and solidarity in most RoSCAs (Ardener, 1964). However, there are RoSCAs in Eastern China and Western Africa, among other places, which specifically prohibit kin and close social relations from joining the same group (*ibid*). The reasons for this, suggested by members of the organizations themselves, are that it is not easy to maintain formal transactions between close relations and it is not 'wise' to attempt to exploit kinship obligations for business purposes (*ibid*). This perspective suggests an interesting parallel to the risks of overembeddedness (Uzzi,

1997). The RoSCAs prohibiting close social ties seem to be suggesting that such strong ties frequently do not result in superior outcomes as one might expect.

In sum, this review of RoSCAs has provided a more socialized view of group lending than is typically found in the microfinance literature. This distinction becomes readily apparent when economic and anthropological views on why group lending has been found to be empirically successful are contrasted. In the economic literature, group lending is suggested to work through its access to local information possessed by group members (Stiglitz, 1990; Ghatak, 1999). In contrast, the anthropological perspective suggests that group lending works because it makes use of customary social patterns of cooperation and mutual help that overcome the risks of fraud and evasion (Geertz, 1962; Ardener, 1964).

3.2.5 Summary of Group Lending Literature

The literature on group lending has been predominately built on a foundation that is based on undersocialized assumptions. The related-work on Rotating Savings and Credit Associations is a notable exception. The core theoretical models assume atomistic agents exploiting local information for their own interests (Stiglitz, 1990; Ghatak, 1999). The empirical studies based on these perspectives have produced inconsistent results (Zeller, 1998; Wydick, 1999). Alternative approaches, including more socialized research (Woolcock, 2001; Anthony, 2005), experimental methods (Cassar et al, 2007; Giné et al, 2010), and ethnographic descriptions (Montgomery, 1996; Brett, 2006) have attempted to more accurately capture the dynamics of group lending. I argue that the microfinance literature would directly benefit from a structural analysis of group lending that maintains the basic social relations in which the borrowers are embedded.

3.3 Social Structure and Economic Action Literature

In the previous section, my review of the microfinance literature highlighted the need for an explicit analysis of the relationship between a group's social structure and its performance. In this section, I review several related strands of literature that provide the foundation for such an analysis. In particular, I review the literature on (1) social embeddedness, (2) social capital, and (3) social network analysis. At times these related literatures overlap (Burt, 2000; Lin, 2001).

3.3.1 Social Embeddedness

Granovetter's (1985) foundational work on the need for 'economic sociology', revitalized Polanyi's (1944) concept of 'embeddedness.' This perspective suggests that human behaviour is "embedded in concrete, ongoing systems of social relations" (Granovetter, 1985, 487). Granovetter criticizes views of economic action that are either 'undersocialized', assuming atomistic, self-regarding agents, or 'oversocialized,' assuming norm-driven generalized morality. He argues for an embedded view incorporating social networks that avoids sweeping generalizations of human motivation. The details of social relations determine the order or disorder of economic life (*ibid*).

Following Granovetter's (1985) work, Uzzi (1996) engaged the primary critique of embeddedness: how do we operationalize the concept in real economic exchanges? To do this, Uzzi explored the relationship between embedded ties and specific economic outcomes: organization survival in the apparel industry (Uzzi, 1996; Uzzi, 1997); capital acquisition and cost in middle-market banking (Uzzi, 1999); and price formation in the corporate law market (Uzzi & Lancaster, 2004). At the dyad level, Uzzi (1996) found embedded ties between organizations result in increased trust, fine-grained information

transfer, and greater joint problem-solving ability between organizations. However, by also considering the effects of embedded ties at the network level, Uzzi (1997) found that a threshold exists in which organizations overly reliant on embedded ties produce lower performance, which he referred to as the 'paradox of embeddedness.' This overembeddedness can produce negative effects such as excessive obligations between organizations and decreased organization adaptability (Uzzi, 1996; Uzzi, 1997).

I suggest that exploring the role of social embeddedness poses significant value to the microfinance literature. The positive effect of social cohesion is assumed to be continually increasing both in microfinance theory (Besley & Coate, 1995; Karlan, 2007) and in practice (MFI, 2007), though there is limited empirical evidence to support such an assumption. An integrated view of the positive and negative effects resulting from embeddedness is notably lacking.

3.3.2 Social Capital

A related strand of literature on social structure and economic action conceptualizes social relations as a form of 'capital' (Lin, 1999). Though it has numerous classical predecessors, the concept has been recently brought to prominence by scholars such as Coleman (1988), for its role in the formation of human capital, Putnam (1995), for its effect on civic engagement, and Burt (2000), as a determinant of competitive advantage. However, the study of social capital has gained such widespread and inconsistent usage that many critics question its value as a concept (Lin, 2001; Adler & Kwon, 2002). Nonetheless, the core intuition that social relations can provide some sort of value distinct from other forms of capital (Lin, 1999), is a powerful concept that is highly relevant to my research on social collateral. I suggest that a key benefit of reviewing the social capital literature is to gain an insight into the controversies that have

arisen with the application of this concept. As such, I focus my review on three primary debates regarding the study of social capital.

The first point of controversy occurs when attempting to move beyond the basic intuition of social capital to a more formal definition. Though looser usage of the term conflates its meaning with societal trust, many scholars point out the need to distinguish between the connections, resources, and outcomes of social capital (Lin, 1999; Portes, 1998; Adler & Kwon, 2002). In regard to the connections, a basic distinction is often made between structural and relational (or formalist and substantialist) studies of social capital, (Adler & Kwon, 2002). Burt's (1992) work on structural holes exemplifies the structural approach, suggesting that it is one's position in a social network that primarily determines competitive advantage. In contrast, studies focusing on the relational aspect of social capital are more concerned with the content of the tie, such as shared norms, beliefs, or abilities (Adler & Kwon, 2002). With such an approach, Portes (1998) suggests how solidarity can be created from a sense of shared destiny. Though the structural-relational distinction offers some insight into deconstructing social capital, others have argued that it is of little value because the two features are inextricably intertwined, i.e. there cannot be a structure without some form of content in the ties (Adler & Kwon, 2002).

The second topic of debate relates to the nature of the social capital resource. Does it accrue to the individual or to the collective (Lin, 1999)? Proponents of social capital as an individual resource see differences in individuals' social networks as opportunities for advantage over those with less optimal network structures (Burt, 1992). Alternatively, proponents of social capital as a collective resource see the nature of a group's social structure producing an environment that benefits or harms all of its members (Coleman, 1988; Putnam, 1995). This difference in perspective introduces a

related issue regarding the primary function of social capital: brokerage versus closure (respectively, Burt, 1992; Coleman, 1988), also referred to as bridging versus bonding social capital (Adler & Kwon, 2002). The role of bridging ties emphasizes how spanning otherwise unconnected clusters of people produces value for a 'broker' (Burt, 1992). In this view, sparse networks with extensive structural holes are rich in social capital opportunities for potential brokers. Conversely, the closure argument proposed by Coleman (1988) argues that dense, closed networks produce greater trust and cooperation for the collective. However, it should be pointed out that these two views of social capital are not necessarily contradictory (Woolcock, 1999; Burt, 2005). For example, Burt (2000) has suggested that the bridging of groups provides the access to novel information and the closure within a group allows for the use and successful implementation of the new information.

The third debated aspect of social capital relates to its effects. Frequently, applications of social capital fail to clearly distinguish between the social connections and their effects (Portes, 1998) which ultimately weakens the concept's value (Lin, 2001). Helping overcome this limitation, some scholars have attempted to categorize the effects of social capital. Sandefur and Laumann (1998) produced an often-cited tripartite distinction of (1) information, (2) influence and control, and (3) solidarity. Lin (2001) suggests a similar set of effects: information, influence, and identity; but he adds a fourth effect of 'verification of social credentials.' These categorizations are valuable for broadly identifying the different types of effects that may be involved in microfinance.

Finally, when considering the outcomes of social capital, it is important to note a key criticism of the literature: the research often focuses on the benefits without regard to the negatives (Portes, 1998). Such a one-sided view of the effects of social structure would be particularly inappropriate for microfinance research. As such, this is one

reason why I draw on the insights from the social capital literature without framing my research in terms of 'social capital,' implying a positive resource. Rather, I analyze both the positive and negative effects of social structure on a group's economic performance.

3.3.3 Social Network Analysis

I now turn to the related literature on social network analysis. Its relationship to the social capital literature can be viewed both as a subset, e.g. the structural view of social capital based on network analysis (Adler & Kwon, 2002), and as part of a broader science of complex systems spanning disciplines such as sociology, biology, and mathematics (Wasserman & Faust, 1994; Newman, 2003). I do not attempt to clarify the relationship here; rather, I use this section to augment my review of the social capital literature in three ways. First, I consider the application of social networks to economic activity that I did not address in the social capital literature review, particularly the broader use of social networks in organization and management studies. Second, I narrow in on studies that have combined social network and spatial proximity analyses. Third, I consider the under explored intersection of network theory and small group research (Katz et al, 2004).

First, it is useful to consider that network analysis has recently gained a new surge of interest due to increased computing power, interdisciplinary analytic techniques, and increased access to large empirical datasets (Watts, 2004). Among this growing body of research, network analysis has found significant traction in the organization and management literature. Broadly speaking, this approach has generated insights regarding organizational forms and the structure of markets (Osborn & Hagedoorn, 1997). For example, Podolny and Page (1998) argue for the existence of network organizations that do not fit the market-hierarchy typology; Powell, Koput, and

Smith-Doerr (1996) explore the use of networks for inter-organizational learning; and Mizruchi (1996) researches the effect of interlocking directorates between organizations. The adaptability of the network approach lends itself not only to considering connections between economic entities, but also the effect of interpersonal connections on the actions of individuals. It has provided insight regarding the role of reputations within organizations (Kilduff & Krackhardt, 1994), the structural cohesion of social groups (Moody & White, 2003), and the economic opportunities produced by one's social network (Burt, 1992; Obstfeld, 2005). Across these diverse levels of analysis and topics within the organization and management fields, the common benefit of studying social networks is shifting the analysis from an overly atomistic frame to a more relational perspective. In the words of Burt, it allows us "to escape the debilitating social science practice of using player attributes for explanation" (1992, 4).

Second, I now focus in on studies that have involved both network analysis and spatial proximity. Though studies have suggested that spatial proximity is often correlated with social connections (e.g. Glaeser, Sacerdote & Scheinkman, 1996), they are often addressed as distinct aspects in social network analysis. For example, Owen-Smith and Powell (2004) consider spatial propinquity as a key feature that affects the flow of information through a social network, and Cowgill, Wolfers, and Zitzewitz (2009) distinguish between physical proximity and social proximity in their analysis of communication and prediction markets. In particular, Cowgill et al found spatial proximity at very close distances, which they refer to as 'microgeography,' to be a stronger predictor of coworker communication than other forms of social proximity, though the strength of the spatial effect rapidly declines with distance. In the context of using spatial proximity as a proxy for social structure, this suggests the importance of using fine-grained spatial data.

Third, though social networks is a substantial area of research, the combination of network theory with small group research is notably underdeveloped (Katz et al, 2004). While numerous studies have analyzed the role of groups *within* the network structure, for example Guimera et al (2005) analyze how team assembly mechanisms determine the structure of collaboration networks, the number of studies that have specifically used network theory to explore the behaviour of small groups is much more limited (Katz et al, 2004). The primary interest so far has involved the effect of small group structure on communication effectiveness (Bavelas, 1950; Leavitt, 1951). More recently, research on this topic has re-emerged and moved the analysis from the experimental lab to field studies in organizations (Brown & Miller, 2000). However, considering small group networks beyond centralization and communication patterns remains an area with significant potential for future research (Katz et al, 2004). This research fits into this gap by considering how a small group's social and spatial structure affects its economic cooperation.

3.4 Experiments on Social Behaviour and Economic Cooperation

Having reviewed a breadth of literature relevant to a structural analysis of group lending, I now address in this section a broad topic of research concerned with different mechanisms that can underlie cooperation (e.g. Ostrom, Gardner & Walker, 1994; Gintis et al, 2005; Durlauf & Blume, 2010). The reason for incorporating this material is to help establish a meaningful bridge between a microcredit group's social structure and its observed collective outcome. I review research that spans sociology, anthropology, and behavioural economics, but which is connected through the use of experimental methods for exploring the mechanisms affecting cooperation. The structure of this section is as

follows: first, I begin by discussing how group lending can be framed in terms of a 'social dilemma' and given an overview of the types of experimental games that are frequently used to explore this category of problem. Second, I summarize behavioural findings produced from this experimental approach. Third, I address assumptions underlying models of economic action. Finally, I discuss the potential implications of this strand of literature on microfinance research.

To begin with, the issue of cooperation in group lending can be framed as falling within a general category of problem referred to as a 'social dilemma' (see Dawes, 1980; Kollock, 1998).[2] The fundamental tension in this type of problem is between the interests of the individual and those of the group. Defined more formally, social dilemmas possess two characteristics: (1) the pay-off to individuals for defecting behaviour is greater than the payoff for cooperative behaviour, regardless of what other group members do; and, (2) all individuals receive a lesser payoff if all defect than if all cooperate (Dawes, 1980). A group lending contract produces this tension: once a loan is disbursed to the group, the individual benefits by not contributing to group repayment, allowing the other members to bear the financial burden (Besley & Coate, 1995). However, the group is better off if all members repay the loan, avoiding legal action by the bank and maintaining access to future credit (Morduch, 1999; MFI, 2007). [3]

To explore the nature of cooperation in such contexts, research on social dilemmas has made extensive use of experiments based on variants of the public goods game (Ostrom, Gardner & Walker, 1994; Gintis et al, 2005; Croson, 2010) and the

[2] This topic has been studied across disciplines under various names: economics – 'public goods'; psychology and sociology – 'social dilemmas'; political science – 'commons dilemmas' (Croson, 2010).

[3] The conflict between individual and group interests is produced if we assume the borrowers are self-interested. The validity of such an assumption is often explored in the social dilemma experiments.

prisoner's dilemma (Axelrod & Hamilton, 1981; Kollock, 1998). In addition to these social dilemma games, related experiments focusing on economic exchange, such as dictator and ultimatum games (Henrich et al, 2004; Andreoni, Harbaugh & Vesterlund, 2010) and trust games (Boero et al, 2009; Bohnet, 2010) offer insight into the social motivation for economic cooperation. Beyond the intuitive relevance that I have suggested of these experiments to group lending, recent research within the microfinance field has begun to use variants of these games in an attempt to better understand the social dimension of group lending, including variations of the public goods game (Abbink et al, 2002; Cassar et al, 2007; Giné et al, 2010), and variations of the trust game (Karlan, 2005; Cassar et al, 2007).

The variety of games that I have referred to have produced results that challenge traditional assumptions underlying cooperation. Traditional views typically assume behaviour is either driven by some form of long-term self-interest or the subordination of one's self-interests to the collective (Gintis et al, 2005). However, the breadth of experiments on social behaviour suggest that human action systematically deviates from such views. For example, a variety of experiments have suggested that altruistic motives exist in a non-trivial portion of the population (Andreoni et al, 2010; Ostrom, 2005). Even when incorporating variants of experiments to account for alternative explanations, such as player confusion and investment in reputation, support is still found for the existance of altruism (Andreoni et al, 2010). Research on reciprocity provides another example of behaviour deviating from homogeneous motivations. Research has expanded on the traditional view of reciprocity, i.e. 'I help you and you help me' (Axelrod & Hamilton, 1981), to consider multiple forms of reciprocity (Nowak & Sigmund, 2005). *Indirect reciprocity* has been suggested, in which 'I help you and someone else helps me' (*ibid*). Such a process begins to involve a complex set of interactions that may be

driven both by strategic investment in one's reputation and altruistic cooperation (*ibid).* Another form, *strong reciprocity,* focuses on altruistic behaviour via costly punishment (Fehr & Gintis, 2007). Strong reciprocity refers to an actor's predisposition to cooperate with others, but to punish defecting group members even at a personal cost (*ibid*). Variations of the public goods game, with and without costly punishment, have provided evidence that actors are neither completely self-regarding, as demonstrated by their use of costly punishment, nor completely norm-compliant, as demonstrated by the decline in cooperation when the threat of punishment is removed (*ibid*).

Such experimental evidence raises meaningful implications for assessing the behavioural assumptions underlying models of economic cooperation. Specifically, the evidence challenges the under- and oversocialized views of economic action (Granovetter, 1985) and suggests conditional behaviour often arises from the interaction of heterogenous actor motivations (Ostrom, 2005; Fehr & Gintis, 2007). For example, Boyd et al (2005) argue that 'conditional cooperators' exist which behave as self-interested individuals if they are functioning in a setting *without* a means of punishment. However, the same individuals will behave as norm-following cooperators in a setting *with* a means of punishment. With a parallel argument, Ostrom (2005) suggests that the level of cooperation in a group is significantly affected by the ability of individuals to engage in face-to-face communication. These perspectives suggest that self-regarding and norm-regarding actors coexist, and the available action opportunities produced by the specific context determine which of the actor types dominates the group's social cooperation (Gintis et al, 2005).

Finally, I build on these findings to argue for the explicit incorporation of social structure into this strand of research. Though the studies discussed (e.g. Fehr & Gintis, 2007; Ostrom, 2005) note the importance of group context on the actions of conditional

cooperators: they do not directly address how the social structure of the group in question determines the ability to engage in the noted activities, such as social sanctioning or face-to-face communication. The group lending context of this research provides a valuable setting in which to explore this proposed connection. For example, a group's level of face-to-face communication and ability to sanction is likely to be affected by the nature of the social relations between the group members. I suggest that a group's social structure changes the opportunities for action and the relative importance of potential social mechanisms affecting cooperation.

4 The Structure of Social Collateral: Embeddedness and Economic Performance in Microfinance

4.0 Abstract

We examine the formal use of social relationships as collateral against loan default, a core feature of modern microfinance. What structural factors determine whether borrower relationships serve as an effective security? Through a rich combination of data on microfinance clients in Sierra Leone, including ethnographic, affiliation survey, GPS, and loan performance, we explore how a microcredit group's spatial structure affects its embeddedness and the efficacy of social collateral. We posit that group structure determines the salience of alternative social mechanisms underlying cooperation. The effects of group structure on economic performance are statistically tested using a dataset of 5,582 repayment-transactions made by 1,884 microfinance clients in Sierra Leone from 2006-2011. Our findings highlight two structural features of social collateral: (1) A group's spatial concentration improves economic performance up to a certain level after which the effect reverses and performance declines. Contrary to predominant expectations in the microfinance literature, groups are significantly at risk of overembeddedness. Though embeddedness enhances the *ability* to sanction, communicate, and build solidarity, high levels reduce the *willingness* to enforce the loan. (2) Groups that consist of multiple spatial fragments produce significantly worse economic performance. Socially, such groups are prone to split into factions and hinder overall cooperation.

4.1 Introduction

Social collateral refers to the use of a borrower's relationships as security against loan default (Besley & Coate, 1995). This explicit integration of social mechanisms with conventional banking models has been a key feature of the global microfinance movement (Anthony, 2005). Over the last four decades, the organized use of social collateral in joint-liability groups has played a key role in the extension of financial services to impoverished populations historically excluded from the financial market (Armendáriz & Morduch, 2010). Despite the explicit reliance on borrower relationships, we have a limited understanding of how the relational structure among borrowers affects their economic behaviour.

The theoretical framework and methodological tools of economic sociology (Polanyi, 1944; Granovetter, 1985) offer great potential for advancing our understanding of social collateral. This approach is offering insight into modern finance (Knorr-Cetina & Preda, 2012) even in contexts where social mechanisms are not as explicitly integrated as in microfinance: the acquisition of financial capital in middle-market banking (Uzzi, 1999), transactions in consumer markets (DiMaggio & Louch, 1998), and the securitization of debt in global markets (Carruthers & Kim, 2011).

Researchers from varied disciplines have long been interested in how relationships can serve as social collateral in debt repayment. Seminal ethnographic studies on rotating savings and credit associations noted the role of social reputation and closure in motivating repayment (Geertz, 1962; Ardener, 1964). During the 1990s, several theoretical models were proposed addressing how group contracts may improve the economic efficiency of a lending institution (e.g. Stiglitz, 1990; Ghatak, 1999). The general proposition in the microfinance literature has been that the greater the social

connectedness of a joint-liability group, the better the loan repayment (Zeller, 1998; Paal & Wiseman, 2011). However, the empirical treatment of group structure has often been coarse-grained, for example, binary coding of a group's social cohesion, and has produced inconsistent findings regarding the mechanisms and effects of social collateral in microfinance (Hermes & Lensink, 2007). Substantial uncertainty remains regarding the conditions under which a borrower's relationships actually serve or do not serve as an effective security against loan default.

To systematically examine social collateral in this study, we use a structural embeddedness framework (Granovetter, 1985) which takes into account social mechanisms informed by the literature on economic cooperation in groups (e.g. Gintis et al, 2005). We investigate how variation in a joint-liability group's internal structure affects its economic performance in terms of loan repayment. In particular, we focus our analysis on the spatial dimension of a group's structural embeddedness (Rivera, Soderstrom & Uzzi, 2010).[1] Substantial prior research has found that spatial structure shapes social interaction in two fundamental ways: (1) through the likelihood of tie formation and (2) by influencing the nature of ongoing interaction (Festinger, Back & Schachter, 1950; Feld, 1981). Variation in social interaction between group members, such as opportunities for communication, solidarity, and punishment, has been found to have a significant impact on economic cooperation in other contexts (Poteete, Janssen & Ostrom, 2010). Our approach puts forward that microcredit group outcomes are not fully determined by the individual characteristics of the borrowers. Rather, a group's spatial

[1] Rivera, Soderstrom, and Uzzi (2010) classify the mechanisms that shape social structure into three categories: (1) assortative mechanisms focused on actor attributes, (2) relational mechanisms emphasizing network position, and (3) proximity mechanisms as discussed in this article.

structure provides a key relational factor in understanding the impact of social collateral on economic performance.

This study employs the following approach for developing and testing our propositions. First, we draw on existing theory and original ethnographic fieldwork with microfinance clients in Sierra Leone to develop refutable propositions on how the spatial structure of a microcredit group relates to its economic performance. Seventy-three interviews were conducted over 54 hours. Second, the role of spatial structure in shaping the social interaction of borrowers is substantiated through a social affiliation survey. Survey data was collected on 410 borrowers and indicate that spatial proximity has a strong effect on the probability of multiplex tie formation. Third, we then use high resolution GPS data to statistically test our propositions with a dataset of 1,884 microcredit borrowers taking a total of 741 group loans. In this step, we use a group's spatial structure as a proxy for its social embeddedness. We test the validity of this assumption using a data subset with social tie information and find that social closure correlates strongly with spatial proximity. The economic performance data includes 5,582 group repayment transactions spanning the period from 2006 to 2011. Extensive controls are applied to account for individual borrower characteristics and group composition, individual business strength and type, and financial and organizational loan features.

Our findings consider the effects of two features of group structure on the efficacy of social collateral. (1) Spatial Concentration: a microcredit group’s economic performance improves up to a certain level as a group’s average spatial concentration increases after which the effect reverses and performance declines. We find that spatial concentration increases a group's structural embeddedness, enhancing performance through greater ability to sanction, communicate, and build solidarity. However, we also

find that groups can frequently become overembedded (Portes & Sensenbrenner, 1993), contrary to the predominant view in the microfinance literature. Worse economic performance results from a reduced willingness to enforce the loan. The financial transaction can become secondary to the social relationships. (2) Spatial Fragmentation: microcredit groups that consist of multiple spatial fragments produce worse economic performance than groups without fragments, regardless of group concentration. Spatial fragmentation can produce subgroups with highly varied levels of structural embeddedness (Festinger et al, 1950). Such groups are prone to split into factions and hinder group cooperation.

This study intends to enhance economic sociology theory in three ways. First, we investigate microfinance, a growing area in economic development that purposefully incorporates social mechanisms into financial models. Our empirical method involves a rich integration of qualitative and quantitative materials. By drawing on diverse data types we are better placed to contribute to the development of theory regarding social collateral (see King, Keohane & Verba, 1994). Second, there has been significant interest in using laboratory experiments to explore the effect of various social mechanisms on group cooperation (Poteete et al, 2010; Bowles & Gintis, 2011). The unique empirical context of joint-liability lending offers a natural field experiment for gauging the relevance of such findings. Third, cross-cultural studies suggest that the interaction of social and economic behaviour can be systematically different in Western and non-Western cultures (Henrich et al, 2004). Sierra Leone provides an understudied example of non-Western economic activity, contributing to a broader understanding of structural embeddedness.

4.2 Theory

4.2.1 Structural Embeddedness and Economic Performance

The concept of embeddedness suggests that economic activity is submerged in social relationships as the general rule, rather than the exception (Polanyi, 1944). The structural aspect of embeddedness, the pattern of relationships in which actors are surrounded (Granovetter, 1985), provides a valuable lens for distinguishing the variation in social collateral that may exist in microcredit groups. Operationally, groups with greater structural embeddedness are often characterized as having a greater number of redundant ties (Coleman, 1988) or a greater multiplicity of tie types between actors (Uzzi, 1999).

Prior research has explored the question of what factors affect the level of structural embeddedness in a group. Rivera et al (2010) classify the relevant mechanisms into three categories: proximity, relational, and assortative. The role of proximity has been found to be particularly important in contexts with lower mobility (Sampson, 1988), in which microfinance programs are typically based. In this study, we explore the effects of spatial proximity on social collateral in depth. Feld's (1981) theory on the focused organization of social ties notes how physical entities, such as workplaces, hangouts, and religious organizations, often serve as foci that shape a community's overall social structure. Physical distance between residences also plays a key role in tie formation by increasing the likelihood of passive contact; for example, a chance encounter walking by a neighbour's door (Festinger et al, 1950). Post tie-formation, proximity influences the frequency of interaction and information exchange (Caplow & Forman, 1950), as well as the effort required to maintain a relationship (Martin & Yeung, 2006).

Our ultimate point of inquiry is how variation in social collateral may affect economic performance. Studies exploring the relationship between structural embeddedness and economic performance have focused on two primary concepts: closure and brokerage. Closure, characterized as a high level of interconnectedness within a group, has been found to enhance trust, development of group norms, and social accountability (Coleman, 1988; Uzzi, 1996). In contrast, brokerage occurs in situations in which actors are able to bridge otherwise disconnected subgroups of a network (Burt, 1992). Brokerage has been found to produce benefits such as access to novel sources of information (Granovetter, 1973) and an enhanced ability to control unconnected players (Burt, 1992).

A balance of closure and brokerage has been empirically shown to enhance economic performance in terms of firm survival (Uzzi, 1996) and entrepreneurial innovation (Burt, 2005; Obstfeld, 2005). In these examples, economic actors are at risk of becoming overembedded. Overreliance on embedded ties and a reduction in access to value added information hinders economic performance.

However, because group loan repayment is primarily a measure of economic cooperation (Anthony, 2005), we question whether overembeddedness is a significant risk for microcredit groups. Descriptive studies involving rotating credit associations have highlighted the positive effects of network closure and community cohesion on group cooperation (Geertz, 1962; Ardener, 1964). But can a group's embeddedness be so great that the efficacy of social collateral declines? Other researchers have noted the potential for collective action failure in highly cohesive groups (Portes & Sensenbrenner, 1993; Flache & Macy, 1996). To further develop our expectations for microcredit behaviour, we turn to the literature on mechanisms shaping group cooperation.

4.2.2 Social Mechanisms of Group Cooperation

The mechanisms underlying group cooperation provide a theoretical link between social collateral and group repayment. The question as to why a group may produce cooperative behaviour when it is in the interest of each individual to defect is one of the fundamental questions of social science (Gintis et al, 2005). This question has been studied across disciplines under the terminology of social dilemmas (sociology and social psychology), public goods (economics), and common dilemmas (political science) (Croson, 2010).

Researchers have often argued over the source of cooperative behaviour, questioning whether it stems from self-regarding interests, such as reciprocity, or from norm-regarding interests, such as group identity (Fehr & Gintis, 2007). In this study, we assume that social structure affects performance regardless of whether agents are primarily self-regarding or norm-regarding. Even with heterogeneous agent motivations, a group's social structure affects the relevant action opportunities and determines which social mechanisms are most salient.

We highlight four social mechanisms, by no means an exhaustive list, that are likely to be affected by a group's structure and have been robustly shown to impact cooperation: (1) communication, (2) identity, (3) reciprocity, and (4) punishment. First, increased communication among group members has been consistently shown to improve cooperation rates (Dawes, 1980; Ostrom, Gardner & Walker, 1994; Kollock, 1998). Communication can produce this effect by allowing actors to gather information more easily on the actions of others, make commitments for future action, and by providing a means for moral suasion (Kollock, 1998). Second, groups with a stronger sense of shared identity have been shown to cooperate more readily. If individuals

identify with and commit to the group itself, a sense of shared fate can emerge (Portes, 1998). Third, multiple forms of reciprocity have been shown to affect cooperation. For example, direct reciprocity, 'I help you and you help me', offers a means over a series of repeated interactions for reducing the risk of being taken advantage of (Axelrod & Hamilton, 1981). Indirect reciprocity, 'I help you and someone else helps me', builds on the same motivation but incorporates the consideration of cooperating in order to enhance one's social image for long-term gain (Nowak & Sigmund, 1998). Fourth, an ability to socially punish or sanction defecting members has been shown to improve cooperation rates. In the absence of those willing to punish or in situations where the defectors are not publically known, cooperation rates are more likely to deteriorate (Boyd, Gintis & Bowles, 2010). In the following section, we draw on our own ethnographic research in Sierra Leone to explore how structural embeddedness influences cooperative behaviour.

4.3 Ethnographic Fieldwork

The ethnographic fieldwork fills two roles in this study. First, we combine the fieldwork with existing theory to develop refutable propositions on the effect of social collateral on economic performance in microcredit groups. The fieldwork provides us with a rich understanding of the social dynamics in these small groups, opens the possibility for unexpected findings, and enhances our ability to contribute to theory development (King et al, 1994). Second, the ethnographic fieldwork is useful for the interpretation of our statistical analysis in subsequent sections. The research provides insight into the mechanisms that relate group structure with repayment.

The empirical research involves a microfinance organization which uses a standard credit model based on small, joint-liability group loans (see Morduch, 1999).[2] Borrowers are jointly liable for the loan that they take out, such that if one or more members of the group do not repay, the other members are held financially accountable. The organization has been in operation since 2002 and has a client base of over 18,000 borrowers spread throughout semi-rural Sierra Leone. We restricted our research sample to the city where the microfinance organization is headquartered as it has a fairly homogenous spatial density. The city has a population of roughly 100,000 residents spread over 16 square kilometres.

Groups were randomly selected from those that had been engaged in borrowing within the previous six months. We conducted interviews with 64 microfinance clients. Interview time totalled 42 hours. Ninety four percent of the clients were female, reflecting the organization's focus on women (84 percent). See Table 4.1 for a summary of interviewee characteristics.

[2] This research was approved by the Central University Research Ethics Committee (CUREC) at the University of Oxford. The review process aims to ensure that research is conducted in a way that respects the dignity, rights, and welfare of participants.

Table 4.1: Summary of Characteristics of Interviewees: Microcredit Clients and Staff in Sierra Leone, 2011

	Female	Tribes	Temne (Tribe)	Business Types	Petty Trader	Group Leader	Interviews	Hours
Clients	93.8%	9	62.5%	6	42.2%	51.6%	64	42.9
Staff	44.4%	4	55.6%	-	-	-	9	14.2
Total							**73**	**57.1**

Note: Interviews were conducted in Sierra Leone between March and June, 2011. Temne is the largest tribe in the research area. Business types of clients are recorded in one of six different categories: Food, Clothing, Service (e.g. haircutting), Petty Trading (selling sundries such as spice, soap, cigarettes, etc), Single Item Trading (e.g. selling bulk palm oil), and Other. Petty Trading is the predominant business type.

We also conducted nine interviews with staff of the organization, including two executive directors, two loan portfolio managers, and five loan officers. Four of the nine staff interviewees were women. Interview time of microfinance staff totalled 14 hours. This provides a critical understanding of how the organization's practices shape the observed group behaviour and also informs the appropriate use of the recorded loan portfolio data in our statistical analyses. We conducted additional interviews with executives and loan officers at three other microfinance organizations in Sierra Leone to verify whether the organizational practices and general group behaviour experienced at the principal organization were typical; the organizational practices and reported group dynamics were highly similar.

4.3.1 The Embeddedness of Microcredit Groups

Potential clients that are interested in taking out a microfinance loan are instructed by the organization to form a group of potential borrowers, typically five, in order to enter into a joint-liability contract. They are told to select members that they 'know and trust' to pay back the loan. This organization does not allow members of the same group to be direct kin (i.e. parents, spouses, or siblings). Each borrower must also

have his or her own business, roughly deemed capable by the loan officer of supporting repayment of the loan.

Our ethnographic research indicated that this self-selection process produces groups with significant variation in embeddedness. Here a borrower from a highly embedded group is describing her interactions with group members:

> *Every day we see each other. Day and night we see. . . . This one, she is my sister-in-law. This one, she is a neighbour to me. . . . We used to discuss issues for our businesses, things that can make us really prosper. We have plans to put things in place that will help us in our progression. . . . We cook, we share food together. . . . We go to the same mosque. The mosque is very close to us. . . . We take care of each other's children. . . . That's why we form a group.*

This embedded group consists of strong personal relationships and multiple types of reinforcing social connections. The quote emphasizes the multiplex nature of many interactions: business, religious, and social. Feld (1981) suggests how spatial location is likely to produce such overlapping connections through the organization of activity around shared social foci. Here another borrower from an embedded group describes her connection to a member:

> *She was born in this community. Her mother is here, her father is also here, her brother and sister are also here. . . . Any hour or any minute I want to see [Hawa], I will see her because we just stay opposite to each other. . . . We sit down and talk. We are used to each other, we are very close to each other. If she has any problem, she informs me so that I will come and assist her. And when I too have a problem, she will come here and assist me.*

In the above example, we see a high degree of structural closure (Coleman, 1988). Even though family members are not allowed in the same group, the borrower is socially connected to the other member's parents and siblings outside the group.

We also found members of highly embedded groups are also more likely to be spatially proximate and interact with each other more frequently (Festinger et al, 1950).

This borrower provides a typical description of the frequency of interaction in embedded groups:

> *We sit down together and talk and laugh. We eat together. . . . We see each other every day. . . . We see [each other] more than 10 times a day.*

While the above examples illustrate highly embedded groups, we encountered many groups that were only weakly embedded by comparison. Such groups were often formed through an informal referral process. A borrower in an unembedded group describes how she was invited to join a group in which she did not previously know the other members:

> *I knew her because we are doing the same business, while I was doing my business in the Big Market. She met me there, and talked to me about business. And then I accept and I joined her in the group. We went together to the office [microfinance organization] . . . then we met everyone [other group members].*

In such groups the structural embeddedness is typically weaker. Instead of a multiplicity of tie types based on personal, religious, and business relationships, they may only have a single connection, for example, through the business market. The frequency of interaction is often greatly reduced. A borrower describes her typical interaction:

> *We see each other monthly. At times we see each other after every two weeks. When it's time for me to pay, we meet as a group. And we select someone who will go back [to the microfinance organization] and pay.*

These examples illustrate the variation between highly embedded and weakly embedded groups. This is not to say that embeddedness only exists at these extremes. Our ethnographic research indicated that there is a range of intermediate levels of embeddedness as well. This is one of the primary reasons why we consider it important

in our statistical analysis to treat embeddedness as a continuous variable and not dichotomize it into coarse-grained measures of embedded or not embedded.

Our ethnographic research also indicated that along this spectrum of embeddedness, various social mechanisms affecting economic cooperation are more or less likely to occur. We have broadly categorized these mechanisms into the benefits and risks for economic cooperation.

4.3.2 Benefits of Embeddedness for Economic Performance

Personal regard for members. Embeddedness can significantly change one's economic behaviour through a stronger personal regard for other members. Personal regard can enhance trust, reciprocity, and solidarity. Multiplex ties serve as a strong basis for trust, can decrease incentives for defection, for example by removing actors from a one-shot prisoner's dilemma, and even promote altruistic behaviour.

This borrower from a highly embedded group describes why he was willing to contribute for group members when they were not able to pay:

> *Our members of the group undergo the same constraints. So I don't want them to strain. . . . You know business is a rise and fall. At times when you bring the business, it sells very fast. But when it happens that it goes very slow and we are about to go and pay, then we assist the individual.*

Beyond a conducive environment for reciprocity, a commitment to the personal relationship can also produce financially altruistic behaviour. This borrower describes her response to a group member's difficulty:

> *It was unfortunate for her that we lost her husband. . . . She decided to come back from the funeral ceremony. After the funeral ceremony I met her. Then we tried to arrange the payment and give her a time. . . . She did not pay the remaining balance of 20,000. But I decided to leave her alone.*

A stronger personal regard combined with a structurally embedded network is also likely to promote group solidarity (Portes & Sensenbrenner, 1993). This borrower describes her shared sense of fate with her group members:

> *The plan that I have is the same plan that [Mariatu] has. And of course the plan that [Mariatu] has, is the same plan that [Hassanatu] has. So we all have the same plan together. So that's why we always keep this plan together. And in fact, that is why we continue to take and pay. We take and pay. We take and pay.*

These examples illustrate consistent trends in the ethnographic data in which strong embedding shifts their logic of exchange from expecting malfeasance to expecting trust and cooperation (Uzzi, 1996).

Communication and coordination. A well-established finding of the cooperation literature is that communication enhances cooperation rates (Ostrom et al, 1994). We found that highly embedded groups communicate more regularly and thus provide easier access to information, increased ability to coordinate, and opportunities to 'negotiate' with other members. Here a member of a highly embedded group describes a norm for coordinating with members if one of them will be out of town when a payment is due:

> *When the person is not around and the time is almost coming very close, we are going to contribute to pay for that individual. But normally they give the money, leave the money before they travel. As soon as a member wants to travel, she needs to plan herself properly before leaving town.*

Regular communication also allows individuals to distinguish if a group member has had a true financial setback or is just unwilling to pay. Members were much less likely to pay for a defecting member if they perceived it to be an issue of unwillingness to pay.

Increased social cost. Members that are highly embedded have a greater opportunity to apply social costs to each other. The ability to sanction in such a closed community structure has been said to produce enforceable trust (Portes & Sensenbrenner, 1993). As defection becomes more costly, cooperation rates should increase (Besley & Coate, 1995; Fehr & Gintis, 2007). A primary means for applying sanctions or social costs is through direct harassment or group pressure. A borrower describes how they consistently applied pressure to a member who was refusing to pay:

> *We cajole her, we keep talking to her. . . . When she refuses to pay after doing all these things, then we go to her house and her place of business . . . in the market place. . . . We go in a group.*

Another means of applying a social cost is through public shaming. Borrowers often noted that they were motivated to contribute their loan payments to avoid public embarrassment. One common means of embarrassment in this context is the police visiting a borrower's home, requesting that he or she proceed to the local court. A borrower describes her concern:

> *When we decided to take this loan, we are always afraid of embarrassment. We don't want to be embarrassed, to go with the police from one point to another. We are always afraid. . . . In fact, we see the embarrassment of others groups.*

In sum, the ethnographic fieldwork has suggested that embeddedness can improve cooperation rates through multiple mechanisms. These mechanisms can both increase the likelihood of a borrower paying his or her own share, as well as increase the likelihood of a borrower paying for another member if he or she is found to be legitimately unable to pay. However, in our ethnographic research we also encountered

several consistent mechanisms impeding economic performance summarized in the following section.[3]

4.3.3 Risks of Embeddedness for Economic Performance

Decreased willingness to enforce. The most striking mechanism we encountered in highly embedded groups was a decreased willingness to enforce on delinquent group members. The strong embeddedness amongst borrowers can actually make the financial transaction of secondary importance to the social relationships. Even though highly embedded groups may have greater ability to enforce the loan, for example through harassment or public embarrassment, they are much less likely to make use of these abilities. Here is a typical example of weak enforcement on a defaulting borrower in a highly embedded group:

> *Even though she was late to pay . . . we never asked her to leave the group. We only tried to cajole her so that she would pay this money. . . . It does not change our friendship, but it did disturb us in the office [microfinance organization].*

Commitment to group solidarity at the cost of more successful members has been found in other economic contexts as well (Portes & Sensenbrenner, 1993; Uzzi, 1996). Microfinance provides a rich example of this phenomenon because the trade-off is explicit; not enforcing on a defecting member directly means that the other borrower must pay the missing share or lose access to future credit. It is also notable that we consistently found this effect even in a context in which no direct kin were allowed in the same group. Highly embedded borrowers often maintained a strong personal

[3] It is important to distinguish that our categorization of benefits and risks for economic performance are in terms of group loan repayment, principally from the perspective of the lending institution. From the borrower's perspective there may be situations in which it is a financial benefit to default on the loan. In such cases, collective group default may be viewed as highly cooperative behaviour.

relationship after the loan, even if it ended due to a member defecting. Borrowers often said that they would not do business again with the defecting member, but that it did not disrupt the other personal ties between them.

In contrast, we did find that borrowers in relatively unembedded groups were much more likely to enforce on each other and risk damaging the relationship, such as escalating the issue to local elders or the police. A borrower in a group that formed through business referrals describes how she continued to pressure a delinquent borrower until she paid, causing the relationship to deteriorate:

> *I put pressure on her, I continue to pressure her so she would pay. It continues until when we went to her mother. . . . We meet her in her mother's house. . . . We continue to go to her father, then to her mother's house to pay. . . . Normally, I used to go with [another member]. At times I go there alone. . . . Then apply more pressure to pay. . . .*

Afterwards, these group members made no attempt to maintain the relationship:

> *We used to see her in the market, but now she is not in the market anymore. It's been so many days without seeing her since she was embarrassed for this money. Just after when she completed paying, then she disappeared.*

The loss of the relationship was not described as of significant concern.

Social influence on collective default. Embeddedness enhances social influence which can produce both positive and negative effects on group repayment. Here we are highlighting the frequent occurrence of embeddedness enhancing a shared interest in defection. If a borrower in a group is considering defection, it is more likely that the entire group can be swayed towards default if they have strong personal connections. We should note that regardless of group embeddedness, when one member defaults it increases the financial burden on other members and increases the subsequent chance of additional defaulters (Besley & Coate, 1995). However, our research indicated that

embeddedness increases the likelihood of collective default beyond the pure financial incentive. An embedded group is more likely to become socially united in its opposition to paying back the lending institution. In the following quote, a member of a highly embedded group describes why the entire group decided not to repay their loan:

> *This is the whole problem. We have children and she, the other one, is not well. I take this money and take care of her health. . . . But since I got these problems, and [the loan officer] knows who I am, I think that he should have tried to talk to me. In that quiet way until I finish paying. But no good words. He just continue embarrassing me, saying all sort of words against me. . . . The entire people in the area, in the community, they heard about it. And this is the reason why we decided not to pay for that money.*

Other members of her group corroborated the motivation for collectively defaulting.

Factions. Even when a group is small, a group's social structure may not be homogenous. A group may consist of subgroups that are highly embedded within themselves, but only weakly embedded as a whole (Festinger et al, 1950). In our interviews we found this to be a particular risk to group cooperation as it may lead to factions. There were many instances in which clients would offer arguments for why they were less willing to pay for a delinquent borrower in a different subgroup. Here, a borrower describes her mistrust for members in another subgroup believing that they made plans to strategically default without telling her:

> *That was the same plan they took. They used the same plan to make an excuse. They said they were going out to buy business [items out of town]. We said, 'No problem, you can go out.' But then . . . after a while, we do not see them back. . . . After three months, they dissolved. You can't see any of them.*

This example illustrates a general theme in the data. Embedded subgroups may benefit from internal cohesion, but the weak connection to another subgroup promotes a disruptive tension in the overall group.

4.4 Hypotheses

In this section, we integrate existing theory with our ethnographic fieldwork on microfinance to develop four refutable hypotheses regarding social collateral. It is known from prior work on evolutionary games in explicit spaces that spatial structure affects cooperation rates (Nowak, Bonhoeffer & May, 1994). Here, we incorporate the literatures on economic sociology and cooperation to posit how a group's spatial structure affects the salience of alternative social mechanisms underlying cooperation. For example, the relevance of social sanctions is likely affected by the group's level of spatial concentration. We draw on our ethnographic analysis to hypothesize the net effect of these social mechanisms on group loan repayment.

The hypotheses concern two features of a group's structure: spatial concentration and spatial fragmentation. Our ethnographic analysis and prior studies (e.g. Festinger et al, 1950; Caplow & Forman, 1950) suggest that spatial concentration increases: (1) the likelihood of multiplex ties, for example borrowers knowing each other through the market, attending the same mosque, and looking after each other's children; (2) the likelihood of social closure, for example borrowers directly knowing the family members and friends of fellow group members; and (3) the frequency of interaction, for example, seeing a borrower multiple times per day independent of loan activity. These structural features are likely to promote certain mechanisms (e.g. increased solidarity, improved communication, and increased social costs) that would increase the likelihood of a group repaying on time. However, structural embeddedness is not an inherently positive force (Portes & Sensenbrenner, 1993) and may actually reduce the efficacy of social collateral. Spatial concentration may also promote mechanisms that derail a group's economic performance, such as a decreased

willingness to enforce the loan or a greater likelihood of collective default through social influence. Based on prior research and our original ethnographic analysis we propose the following hypotheses:

> *$Hypothesis_1$: As a group's average spatial concentration increases, a group's economic performance improves, measured in terms of timeliness of loan repayment, controlling for individual borrower characteristics, individual business characteristics, and group loan characteristics.*

> *$Hypothesis_2$: If a group's average spatial concentration increases beyond a certain level, the effect reverses and a group's economic performance declines, controlling for individual borrower characteristics, individual business characteristics, and group loan characteristics.*

Taken together, Hypotheses 1 and 2 propose that spatial concentration at either the low or high end of the spectrum will hinder performance. Prior studies have found a similar non-monotonic relationship with economic performance in other contexts (e.g. Uzzi, 1996; Burt, 2005). However, the risk of overembeddedness is substantially less clear in the microfinance literature (Hermes & Lensink, 2007).

Hypotheses 3 and 4 regard the effect of spatial fragmentation on group loan repayment. A spatially fragmented group consists of subgroups in which the borrowers are internally proximate, but the subgroups are spatially distant from each other. This spatial structure is associated with subgroups that are more highly embedded than the rest of the group, which are likely to reduce overall group cohesiveness and may result in factions (Festinger et al, 1950). The following hypothesis posits that spatial fragmentation reduces the efficacy of social collateral:

$Hypothesis_3$: Groups that consist of multiple spatial fragments produce worse economic performance than groups which do not consist of multiple spatial fragments, controlling for individual borrower characteristics, individual business characteristics, and group loan characteristics.

Based on our ethnographic analysis, we expect that the risk of spatial fragments on group performance is likely to be more detrimental if the overall group concentration is low. As a fragmented group's overall distance increases, it becomes increasingly difficult, for example via less face to face communication (Ostrom et al, 1994), to avoid a breakdown of cooperation between subgroups. We propose the following interaction effect between spatial concentration and fragmentation:

$Hypothesis_4$: For groups consisting of multiple spatial fragments, as a group's average spatial concentration decreases, a group's economic performance declines, controlling for individual borrower characteristics, individual business characteristics, and group loan characteristics.

4.5 Statistical Data and Methods

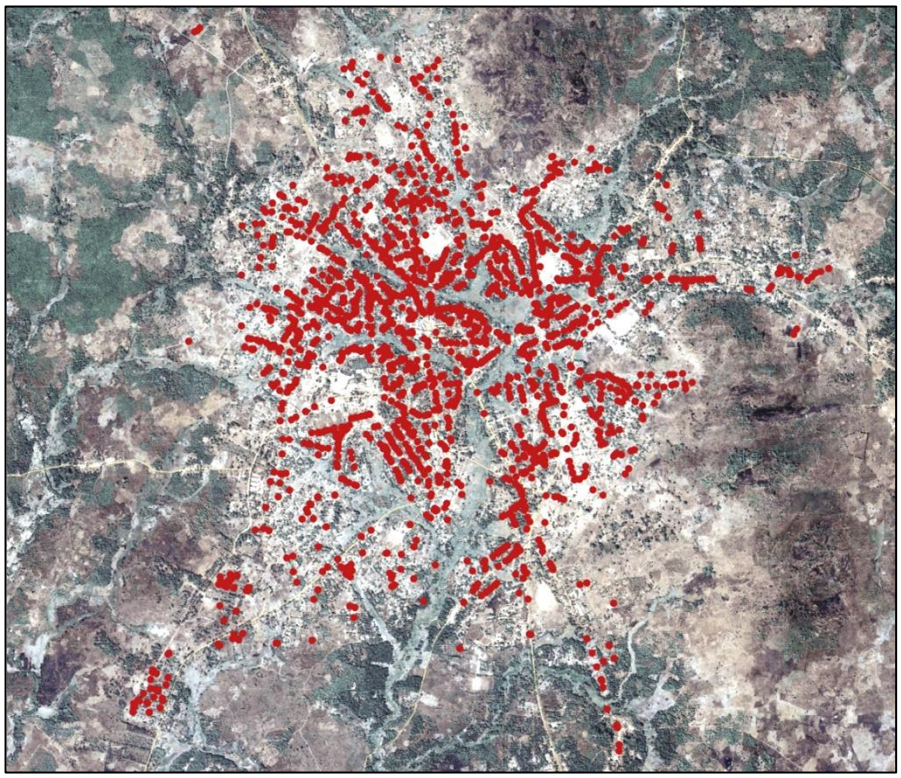
4.5.1 Data Overview

We used a dataset from the microfinance organization in Sierra Leone that was described in the Ethnographic Fieldwork section. All the loans in the dataset were provided under a joint-liability contract such that if one of the group members did not repay, the other members were held financially responsible. The data consist of 1,884 unique borrowers constituting 406 unique groups. These groups received a total of 741 loans over a five-year period, from 2006 to 2011. During that period 5,582 monthly group repayment transactions were recorded.

The data include (1) individual personal characteristics, (2) individual business characteristics, (3) GPS spatial coordinates of borrowers' residential addresses, (4) group loan membership and terms, and (5) group loan repayment. We used data at the level of the individual borrower to construct group-level measures of spatial structure that we relate to group-level performance. A subset of 410 borrowers were surveyed in 2011 regarding their social affiliations to test our construct validity.

All the borrowers live in a single city in Sierra Leone with a population of roughly 100,000 residents spread over 16 square kilometres. GPS coordinates for residential addresses registered with the microfinance institution were collected by the authors using a Trimble Juno SC unit with ArcGIS software. See Figure 4.1 for a map of the distribution of clients.

Figure 4.1: Spatial Distribution of Microcredit Clients in Sierra Leone, 2006-2011



Note: Data gathered by GPS in city of study, Sierra Leone.

All the groups were self-selected; borrowers interested in taking a loan were told by the organization to select group members that they knew and trusted. All the loans were intended for investment in individual micro-businesses and were scheduled for monthly repayment over 6 to 12 months. Members of the same group all received equal loan amounts and the same loan terms. The amount of the group loans ranged from 1.2 million to 7.5 million Leones (SLL), with each borrower receiving between 300 thousand to 1.5 million SLL, approximately $70 to $345 USD respectively at the time of data collection. Of the 1,884 borrowers, 84 percent were female. Table 4.2 provides a summary of descriptive statistics.

Table 4.2: Descriptive Statistics: Microcredit Groups in Sierra Leone, 2006-2011

	N	Mean	SD	Min	Max
Borrowers	1,844				
Groups	406				
Loans	741				
Spatial Structure					
Spatial Concentration		.00	1.00	-4.25	1.05
Spatial Fragmentation (1=Fragments)		.11	.31	.00	1.00
Group Characteristics					
Group Size		4.58	.49	4.00	5.00
Proportion Female		.84	.22	.00	1.00
Proportion Married		.93	.14	.25	1.00
Average Number of Children		3.16	.86	1.00	6.50
Financial Characteristics					
Average Monthly Sales		.82	.35	.20	4.85
Standard Deviation Monthly Sales		.22	.41	.00	6.77
Average Business Equity		.95	.38	.24	3.98
Proportion Petty Traders		.64	.29	.00	1.00
Business Type Diversity		.00	1.00	-1.50	3.12
Loan Characteristics					
Group Loan Amount		2.43	1.14	1.20	7.50
Loan Cycle		2.14	1.43	1.00	9.00
Loan Officer 1		.05	.22	.00	1.00
Loan Officer 2		.01	.12	.00	1.00
Loan Officer 3		.16	.37	.00	1.00
Loan Officer 4		.21	.41	.00	1.00
Loan Officer 5		.20	.40	.00	1.00
Loan Officer 6		.11	.31	.00	1.00
Loan Officer 7		.07	.25	.00	1.00
Loan Officer 8		.01	.09	.00	1.00
Dependent Variable					
Days Overdue		35.08	85.58	-4.00	536.0

Note: Financial Amounts in Millions of Leones (SLL)

4.5.2 Independent Variables

We have proposed that spatial structure is a key factor shaping a microcredit group's social interactions. Numerous studies in other contexts have explored the relationship between proximity and social interaction (e.g. Festinger et al, 1950). However, before proceeding with our analysis, we prefer to test this assumption with our empirical data from Sierra Leone. Here, we consider the relationship between spatial proximity and the probability of a multiplex social tie, a common feature of structural embeddedness (Granovetter, 1992).

We conducted a survey on all the microcredit clients receiving a loan from the lending institution over the first six months of 2011. Complete survey data was collected on 378 of the 410 clients receiving a disbursement (92.2 percent). Clients were asked to list their social affiliations in terms of (1) religious organization, (2) place of business, (3) educational organization, (4) Osusu, informal savings group (see Geertz, 1962), and (5) ethnic tribe. Clients were instructed only to report affiliations in which they had been active in the previous six months (referring to affiliations 1-4). Table 4.3 provides a summary of the social affiliation survey data. As stated previously, the data also include GPS coordinates for residential addresses.

The social affiliation surveys were administered by the loan officers to the clients directly before disbursing the loans. What form of survey bias should we consider in this context? The data was gathered after the clients had been approved and informed that they would receive a loan. However, not yet having received the actual disbursement, clients may still suspect that their responses could influence their loan eligibility. The most likely bias here is clients potentially over-reporting social affiliations that may be deemed desirable by the microfinance institution. For example, clients may overstate

their participation at the local mosque or university in the last six months. Given this potential bias, we employ a conservative approach for measuring embeddedness based on a multiplex tie.

A multiplex tie was operationalized as having two or more social affiliations in common (religious organization, place of business, educational organization, or informal lending group).[4] We examined the likelihood of a multiplex tie rather than a single affiliation as it serves as a stronger measure of structural embeddedness. Single affiliations to such groups may represent a relatively weak tie (Feld, 1981).

Table 4.3: Summary of Social Affiliation Survey: Microcredit Clients in Sierra Leone, 2011

	Social Foci				
	Religious Organization	Place of Business	Educational Organization	Informal Lending Group	Tribe
Surveyed Clients	410	410	410	410	410
Completed Surveys	378	378	378	378	378
Reported Affiliations	355	310	153	198	372
Reported Distinct Foci	82	127	43	136	13
Mean Affil/Focus	4.3	2.4	3.6	1.5	28.6
Std Dev Affil/Focus	5.5	4.2	3.5	.8	74.3
Min Affil/Focus	1	1	1	1	1
Max Affil/Focus	34	33	13	5	274

We fitted a binary logistic regression model to the likelihood of a multiplex tie. Such a connection is possible between any two members of the 378 survey respondents, producing a potential 71,253 ties. The model included controls for individual attributes that may affect the probability of a tie: tribe, gender, marital status, group leader status,

[4] We do not use ethnic tribe as a social affiliation in this analysis. With 72.5 percent of the respondents belonging to the largest tribe (Temne), it does not represent a meaningful social affiliation. Instead, it is used in the analysis as a control variable.

business type, business strength, number of children, and number of additional dependents.

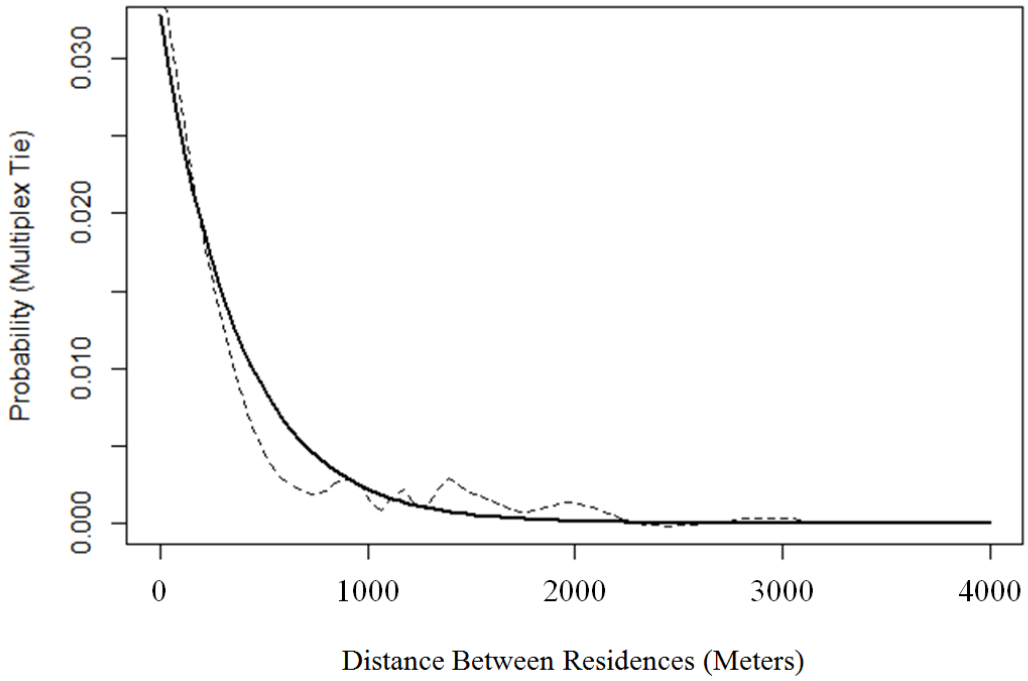
Table 4.4: Binary Logistic Regression Predicting the Effect of Spatial Proximity on Multiplex Social Tie Probability in Sierra Leone, 2011

	Model 1		Model 2	
	Coefficient	S.E.	Coefficient	S.E.
Spatial Distance	–	–	-2.716***	(.160)
Tribe (1 = Match)	.418***	(.121)	.258*	(.131)
Gender (1 = Match)	.451*	(.175)	.380*	(.192)
Marital Status (1 = Match)	.602**	(.214)	.540*	(.237)
Group Leader (1 = Match)	-.328**	(.118)	-.288*	(.128)
Business Type (1 = Match)	.378**	(.120)	.440***	(.130)
Monthly Sales Difference	-.726***	(.170)	-.570**	(.182)
Number Child Difference	-.192***	(.050)	-.141**	(.054)
Number Dependents Difference	-.098	(.064)	-.099	(.074)
Constant	-6.138***	(.300)	-3.752***	(.334)
Deviance	3819.0		2837.4	

Note: N = 71, 253 potential ties;
Distance in kilometres; Financial amounts in millions of Leones (SLL);
**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

Table 4.4 provides the results of the regression. Model 1 provides a baseline control model. Referring to Model 2, the coefficient of spatial distance is negative and significant with a p-value < 0.001. As spatial distance increases, the likelihood of a multiplex social tie significantly decreases. Figure 4.2 displays how rapidly the probability decays with distance. The figure displays both the functional form fit by the regression model and the empirical deviation around the function form. The analysis provides empirical support that spatial proximity in this context captures substantial social information.

Figure 4.2. Multiplex Social Tie Probability Spline: Microcredit Clients in Sierra Leone, 2011

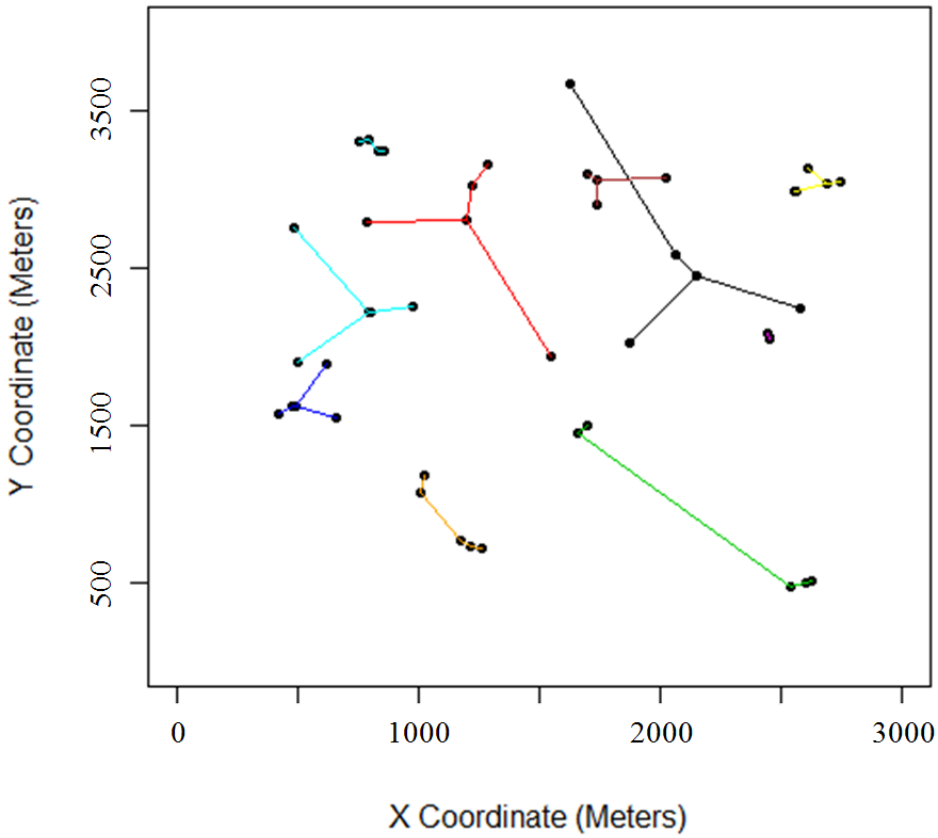


Note: N = 71,253 potential ties. The solid line shows the implied relationship of the functional form produced by logistic regression, holding other variables at their means (see Table 4.4); the dotted line shows a 20-piece spline of the empirical likelihood of a multiplex social tie.

Returning to the principal analysis with 1,884 borrowers, we constructed spatial measures of group structure. We considered two features: (1) *Spatial Concentration* and (2) *Spatial Fragmentation*. Spatial calculations used the Euclidian Minimum Spanning Tree (EMST) based on borrowers' residential addresses. The EMST calculates the shortest overall distance to connect a group's set of addresses (see Eppstein, 2000). We considered alternative approaches for calculating a group's spatial structure, but found

the EMST to be both parsimonious and appropriate for the context.[5] See Figure 4.3 for EMST examples of empirical microcredit groups.

Figure 4.3: Euclidian Minimum Spanning Trees: Microcredit Groups in Sierra Leone, 2006-2011



Note: 10 microcredit groups illustrating different spatial configurations from the empirical city of study, Sierra Leone. Full dataset: 1,884 borrowers constituting 406 EMSTs.

[5] We considered alternative approaches to calculating a group's spatial distance, such as using travel distance, pair-wise distance, and the convex hull. Fieldwork indicated that most borrowers travel by foot and take a fairly direct path to their destinations given the city layout. Given the expected similarity, Euclidian distance was preferred over travel distance for its simplicity. Alternative Euclidean-based measures of average spatial dispersion (the average of all pair-wise distances within a group and the convex hull) were examined, but the EMST was found to produce a more consistent measure of small group dispersion.

The average group EMST was 1.06 kilometres, with a range from 0 metres (groups that are residentially co-located) to 5.24 kilometres. The average EMST branch length was 299 metres. To put the distances in context, the city is roughly 4 kilometres in diameter. The spatial concentration variable was constructed by using a group's average EMST branch length and reversing the sign to capture concentration rather than dispersion. The variable was mean-centred with a standard deviation of one.

The second feature of structure we considered is spatial fragmentation. We treated this measure as a binary variable with one representing groups consisting of multiple spatial subgroups; zero otherwise.[6] A subgroup was defined as two or more borrowers living within less than 100 metres of each other. Two subgroups were considered to be distinct if there was a distance of more than 100 metres between their nearest members. One would expect that the relevant threshold distance for defining a subgroup is context dependent. Our use of 100 metres was derived from the fieldwork as a critical distance for frequent interaction. For individuals living less than 100 metres apart, regular social interaction on a daily basis was largely unavoidable.

We were able to collect spatial data on 95.2 percent of the borrowers. The unknown spatial data was primarily due to human error during the original recording of borrowers' addresses; we consider the 4.8 percent of the missing spatial data to be at random.

Most groups in the dataset, 90 percent, have no change in group membership over subsequent loans. However, if there was a change in group membership between loans, we considered the resulting group distinct from the prior group and accordingly associated it with the new group's spatial structure.

[6] Though a continuous measure of spatial fragmentation may be of use, we found it difficult to construct a consistent continuous measure for our purposes that did not introduce artefacts.

4.5.3 Dependent Variables

We modelled a microcredit group's performance using loan repayment data. For each group loan, the number of days early or late that each monthly payment was made has been recorded. The detail of the performance distribution is more fine-grained than that used by numerous other studies of microcredit that have focused on the default rate (e.g. Wydick, 1999; Paxton, Graham & Thraen, 2000). Days overdue provides significant insight to group performance because default is relatively rare (6.2 percent of loans in this study). To construct a loan-level performance measure, we used the maximum number of days overdue for all the scheduled payments of the loan. A higher value of the dependent variable indicates worse group performance.[7]

We consider this performance measure to be primarily an indicator of a group's cooperation rather than financial ability for three reasons. First, ethnographic fieldwork on group lending, including but not limited to our own fieldwork in Sierra Leone, suggests that a group's repayment is predominately an issue of the *willingness* to pay rather than *ability* to pay (Geertz, 1962; Anthony, 2005). Second, if the microfinance organization deems that a group as a whole has encountered an event that prevents it from repaying, for example if the members' business stalls were co-located and damaged in a fire, the organization will reschedule the loan. Third, the microfinance organization requires that 10 percent of each loan is immediately placed into a group deposit account. If the group is financially unable to make a payment, they have the option of using this

[7] Defaults are included in the performance distribution using the number of days overdue when the organization wrote off the loan. We took various steps to verify that the results are not sensitive to this treatment of the dependent variable. We considered that default could be viewed as a different category than days overdue. We constructed models treating days overdue as censored data and, separately, focused specifically on modelling the hazard rate of loan default. The relationship between the explanatory variables and performance is consistent across these alternative approaches. See Appendix for additional detail.

account to cover the missing payment. However, this option is rarely used by overdue groups, suggesting a failure of group cooperation rather than financial inability to repay.

4.5.4 Control Variables

We controlled for the following types of variables: (1) individual borrower characteristics, (2) individual business characteristics, and (3) group loan characteristics. We used both the individual borrower characteristics and individual business characteristics to construct group-level controls. Individual borrower characteristics converted to group composition controls include *proportion female, proportion married,* and *average number of children.*

To control for the financial strength of borrowers' businesses, we considered monthly sales and business equity. These measures are estimated by the clients and audited by the loan officers during the pre-loan screening process. Business equity in this context is primarily based on business assets as the upcoming liability from the microfinance institution is not included. In addition to *average monthly sales* and *average business equity* for each group, we also included *standard deviation monthly sales* to control for the possibility that within-group differences in financial strength affect cooperative behaviour.

We also controlled for a borrower's business type. Based on information gathered by the loan officer, each borrower's business was categorized into one of six types: Food, Clothing, Service, Petty Trading, Single Item Trading, and Other. The predominant business type of borrowers in this dataset is Petty Trading at 64 percent. Using the business type data, we constructed two group-level controls: *proportion petty traders* and *business type diversity*. Proportion petty traders captured the group's focus on the predominant business type. Business type diversity was calculated as the number of

different business types within the group, divided by the number of group members. This value was then normalized with mean of zero and standard deviation of one. Business type diversity is a particularly important control because one should question whether the effects of spatial concentration are actually driven by correlation of business types (an undiversified portfolio) rather than social mechanisms.

Characteristics of the loan that we controlled for included *group size*, *loan amount*, *loan officer* (dummy variables for nine loan officers), and *loan cycle* (the number loan taken by the group, i.e. first, second, third, etc).[8]

[8] Additional models were built controlling for exogenous factors using dummy variables for time periods: six month periods based on the primary rainy and dry seasons in Sierra Leone. The substantive results were unchanged.

4.5.5 Statistical Model

We modelled the effects of spatial concentration and fragmentation on loan repayment using a hierarchical linear model for repeated measures (Snijders & Bosker, 2012). As groups may take multiple loans and their performance may not be independent, we included random intercepts for each microcredit group. We estimated a model of the following form:

$$Y_{ij} = \gamma_{00} + \gamma_{10}x_{1ij} + \ \dots \ + \ \gamma_{p0}x_{pij} + \ \gamma_{01}z_{1j} + \ \dots \ + \gamma_{0q}z_{qj} + U_{0j} + R_{ij} \quad (4.1)$$

where Y_{ij} denotes days overdue for loan *i* for microcredit group *j*. γ_{00} is the intercept; γ_{p0} is the coefficient for the loan-level variables, x_{pij}; γ_{0q} is the coefficient for the group-level variables, z_{qj}; U_{0j} is the residual at the group level; and R_{ij} is the residual at the loan level (*ibid*). We considered alternative approaches to modelling the data and found the results were robust to our model selection.[9]

4.6 Results

Table 4.5 summarizes four models testing the hypotheses derived from our ethnographic fieldwork. Models 3 and 4 relate to Hypotheses 1 and 2 on the effects of spatial concentration. Model 5 tests the effect of spatial fragmentation, Hypothesis 3. Model 6 tests the interaction effect of spatial concentration with spatial fragmentation, Hypothesis 4.

[9] To test the robustness of our model selection we considered alternative statistical models: Tobit regression (considering early repayment and default to be censored data) and discrete-time event history models (based on risk of delinquency and default). The results are substantively the same. We also performed additional analyses to verify that the model was correctly specified. The Appendix contains further detail on log transformation of the dependent variable, variance inflation factors, and tests on the effects of loan officers. The supporting analysis indicates that our statistical approach is robust.

4.6.1 Spatial Concentration

Model 3 serves as a baseline control model accounting for group composition, financial indicators, and loan characteristics. Model 4 introduces variables for spatial concentration and spatial concentration squared. The coefficient of spatial concentration is positive and significant with p-value < 0.01, indicating that as a group's spatial concentration increases its performance declines (i.e. more days overdue). The coefficient of spatial concentration squared is also positive and significant, with a p-value < 0.05, indicating that the relationship between concentration and performance is nonlinear. The F-statistic for improvement in fit over a linear model is significant with a p-value < 0.02.[10] It indicates that groups of moderate spatial concentration perform better than those groups with very high or very low levels of spatial concentration. Together, the results of Model 4 support Hypotheses 1 and 2. Figure 4.4 provides a graphical summary of the empirical relationship.

[10] We statistically validated that a second degree polynomial provides the best fit to the empirical data, considering both first and third degree polynomials. Additionally, we visually examined the relationship using a multi-piece spline, indicating that the use of a second degree polynomial is appropriate.

Table 4.5: Hierarchical Linear Regression Predicting the Effect of Spatial Structure on Microcredit Economic Performance in Sierra Leone, 2006-2011

	Model 3		Model 4	
	Coefficient	S.E.	Coefficient	S.E.
Spatial Structure				
Spatial Concentration	–	–	10.799**	(4.111)
Spatial Concentration Squared	–	–	4.273*	(2.147)
Spatial Fragmentation	–	–	–	–
Spatial Concentration x Fragmentation	–	–	–	–
Group Characteristics				
Group Size	3.505	(7.324)	3.064	(7.326)
Proportion Female	13.069	(14.282)	8.401	(14.361)
Proportion Married	25.499	(22.038)	28.397	(21.963)
Average Children	-.414	(3.528)	-1.349	(3.542)
Financial Characteristics				
Average Monthly Sales	5.614	(18.910)	4.845	(18.857)
Standard Deviation Monthly Sales	8.518	(11.771)	8.268	(11.738)
Average Business Equity	-16.972	(13.272)	-14.315	(13.263)
Proportion Petty Traders	-13.309	(14.225)	-15.526	(14.183)
Business Type Diversity	5.721	(6.219)	4.811	(6.205)
Loan Characteristics				
Loan Amount	10.489	(5.918)	11.208	(5.898)
Loan Cycle	4.330	(4.556)	4.730	(4.538)
Loan Officer 1	10.434	(16.914)	12.674	(16.871)
Loan Officer 2	85.363***	(25.105)	84.921***	(25.021)
Loan Officer 3	12.206	(11.098)	15.096	(11.102)
Loan Officer 4	83.893***	(10.231)	85.927***	(10.265)
Loan Officer 5	-6.113	(9.722)	-6.629	(9.718)
Loan Officer 6	2.443	(13.949)	-.074	(13.944)
Loan Officer 7	-2.626	(14.839)	-1.620	(14.803)
Loan Officer 8	5.814	(34.334)	5.614	(34.178)
Constant	-50.172	(41.894)	-52.206	(42.002)
Deviance	8553		8546	

Note: N = 741 loan observations (based on 1,884 unique group members)

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

Table 4.5 (continued)

	Model 5		Model 6	
	Coefficient	S.E.	Coefficient	S.E.
Spatial Structure				
Spatial Concentration	–	–	12.197**	(4.194)
Spatial Concentration Squared	–	–	5.147*	(2.165)
Spatial Fragmentation	18.656**	(9.387)	36.689**	(12.545)
Spatial Concentration x Fragmentation	–	–	-47.416*	(19.994)
Group Characteristics				
Group Size	1.219	(7.395)	1.176	(7.360)
Proportion Female	12.112	(14.252)	9.512	(14.292)
Proportion Married	26.198	(21.982)	26.63	(21.854)
Average Children	-.430	(3.519)	-1.080	(3.523)
Financial Characteristics				
Average Monthly Sales	4.517	(18.868)	3.700	-18.750
Standard Deviation Monthly Sales	8.154	(11.742)	8.493	(11.674)
Average Business Equity	-15.995	(13.246)	-12.833	(13.194)
Proportion Petty Traders	-13.816	(14.189)	-15.144	(14.104)
Business Type Diversity	5.090	(6.211)	4.067	(6.174)
Loan Characteristics				
Loan Amount	10.911	(5.906)	11.714*	(5.866)
Loan Cycle	4.015	(4.546)	4.038	(4.517)
Loan Officer 1	10.026	(16.870)	11.382	(16.776)
Loan Officer 2	82.511***	(25.079)	86.669***	(24.966)
Loan Officer 3	12.265	(11.068)	13.031	(11.068)
Loan Officer 4	83.908***	(10.204)	85.420***	(10.207)
Loan Officer 5	-6.129	(9.697)	-6.420	(9.661)
Loan Officer 6	2.112	(13.913)	-.524	(13.862)
Loan Officer 7	-2.834	(14.800)	-2.908	(14.724)
Loan Officer 8	7.198	(34.250)	5.667	(33.984)
Constant	-41.552	(42.008)	-46.453	(41.939)
Deviance	8549		8537	

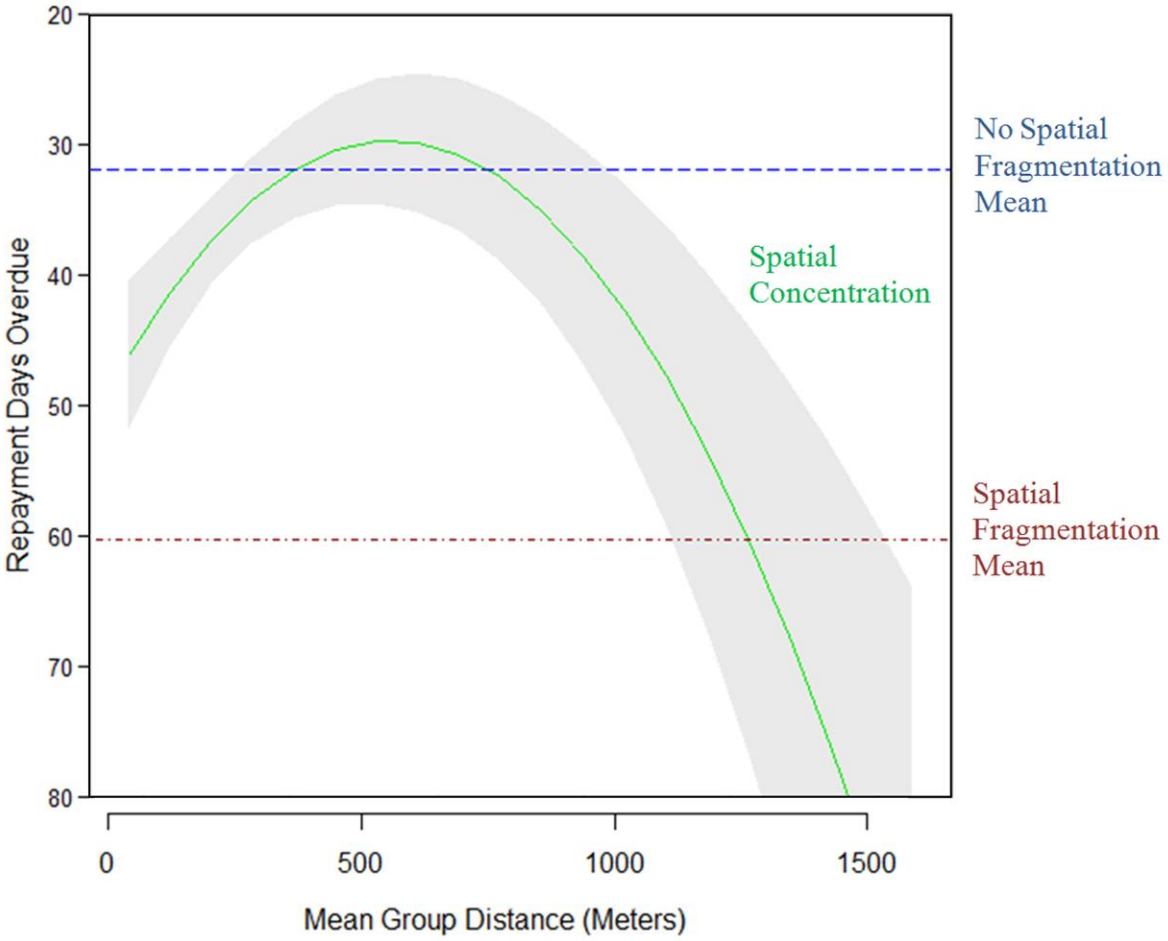
Note: N = 741 loan observations (based on 1,884 unique group members)

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

The positive coefficient of the linear spatial concentration term in Model 4 indicates that in this dataset there is actually an overall trend of highly concentrated groups producing worse performance. This is somewhat surprising because the most common expectation for group lending is a net benefit from embeddedness (Geertz, 1962; Zeller, 1998). However, recall that the group formation process is based on self-selection. It is interesting that this process empirically results in a greater frequency of high concentration groups, for example average distance between members of less than 500 metres. We note that borrowers may prefer proximate members for reasons that do not necessarily translate into improved loan repayment from the perspective of the lending institution, for example trust over diversification. For further analysis of the selection mechanisms that motivate the formation process, see Author citation (2014).

We have taken several additional steps to test empirically if worse performance associated with high levels of spatial concentration is driven by mechanisms related to social interaction as we hypothesized, rather than alternative explanations, such as the covariance of financial risk. Using the subset of borrowers on which we collected social affiliation survey data, we were able to test directly the effect of social closure on group performance. We examined the effect of transitivity (Wasserman & Faust, 1994), operationalized as the number of closed triads over all potential triads within each group. We found that higher values of transitivity result in more days overdue, providing further evidence that the risk of overembeddedness for microcredit groups is socially based. See the Appendix for additional detail on the model results examining the effect of transitivity on performance.

Figure 4.4: Empirical Relationship of Group Spatial Structure and Microcredit Economic Performance in Sierra Leone, 2006-2011



Note: N = 741 group loans (1,884 unique borrowers). Distance based on average meters between borrower residences. Curve fitted with hierarchical linear regression model (see Table 4.5 Model 6). Shaded region displays standard error. Control variables held constant at mean values.

In contrast to a social interpretation, one might question whether the effect of spatial concentration is a result of financial performance covariance. As a first step, we included control variables in the statistical analysis for business type diversity, or lack thereof, and found that business type diversity does not have a significant effect on group repayment. We tested this issue further by considering spatial autocorrelation of performance, regardless of business type. For example, perhaps negative financial shocks occurred to certain spatial areas of the city over time. Spatially concentrated

groups would be at greater risk of members simultaneously unable to pay. We test this possibility by analyzing the spatial autocorrelation of the performance of all 741 loans in the principal dataset. We use a standard measure of spatial autocorrelation, Moran's I (Moran, 1950). The statistic is applied to year-long performance windows from 2006 to 2011. The Moran's I statistic is consistently insignificant with a mean p-value of 0.73 over the six years, indicating that loan performance in this city is not spatially autocorrelated. See the Appendix for additional detail on spatial autocorrelation of performance.

4.6.2 Spatial Fragmentation

Model 5 (Table 4.5) introduces the binary variable for groups with multiple spatial fragments. The coefficient is positive and significant with p-value < 0.01. This provides support for Hypothesis 3 that groups consisting of multiple spatial fragments perform worse than groups without spatial fragments. The size of the effect is substantial; the mean days overdue for fragmented groups is 28.3 days greater than non-fragmented groups.

Model 6 is the full model including the interaction effect between spatial concentration and spatial fragmentation. The coefficient of the interaction effect is negative and significant with p-value < 0.05. This indicates that if a group consists of multiple spatial fragments, the higher the level of average spatial concentration for the group, the better the group performs with fewer days overdue. This provides support for Hypothesis 4.

4.7 Discussion

Over the last four decades, a general tenet of the microfinance movement has been that social cohesion can be leveraged to create non-conventional models for financial inclusion (Armendáriz & Morduch, 2010). It is generally accepted that group lending harnesses some form of social collateral. However, empirical analysis of the structural factors influencing group loan outcomes has substantially lagged behind theory and practice (Anthony, 2005; Karlan, 2007). In this paper, a unique combination of ethnographic and statistical data allows us to explore how the structure of social collateral affects group repayment. We presented empirical evidence that spatial structure shapes the nature of social interaction in microcredit groups and impacts the efficacy of social collateral. After controlling for individual attributes, business characteristics, autocorrelation of economic performance, and features of the loan, we still see a significant effect of spatial structure on group repayment.

We have found that two features of a group's spatial structure, average concentration and fragmentation, affect economic performance in systematic ways. Our first substantive finding indicates that spatial concentration improves a group's economic performance up to a certain level. At high levels of spatial concentration, the effect reverses and performance declines. Our ethnographic fieldwork indicates that structural embeddedness can enhance economic performance through increased personal regard for group members, improved communication and coordination, and increased social cost for defection. However, we found that groups can frequently become overembedded. A reduced willingness to enforce the loan and an increased likelihood for collective default can result in worse economic performance. In such highly

embedded groups, the financial transaction can become secondary to the social relationships.[11]

What confidence should we have in the generalizability of these findings? While the data is drawn from a single microfinance institution in Sierra Leone, throughout the research process steps were taken to confirm that the institution was employing group lending practices common to other geographic and cultural contexts. For example, similar group lending models have been studied in Jordan (Azzam, Hill & Sarang, 2012), Eritrea (Hermes, Lensink & Mehrteab, 2005), Burkina Faso (Paxton, Graham & Thraen, 2000), and Guatemala (Wydick, 1999). The practices used by these institutions are highly similar in terms of group size, group selection and screening processes, loan enforcement processes, and dynamic incentives for subsequent loans. In sum, while the quality of empirical data in this study is unusually high, the group lending model and institutional practices are common, strengthening the study's external validity.

This finding has an interesting parallel to previous research which has noted that a balanced level of embeddedness offers economic advantages in other contexts such as inter-firm exchange, career progress, and group creativity (Uzzi, 1996; Burt, 2005; Uzzi & Spiro, 2005). Here, the microfinance context draws particular attention to the risk of overembeddedness. The risk is highlighted because joint-liability group repayment can effectively be viewed as a collective action problem (Anthony, 2005) with social collateral as the primary security against defection. The benefits of structural embeddedness for ensuring group cooperation are fairly intuitive (Coleman, 1988). However, to quote Flache and Macy (1996, 4), "We believe the 'obviousness' of this

[11] One should note that the effects of embeddedness on group performance may not be symmetrical. The group formation process in the Sierra Leone context does not result in many, if any, groups that are completely unembedded. Thus, we are not able to directly compare the relative downside of an overembedded group to a completely unembedded group.

assumption has obscured a potentially devastating weakness of strong ties." They argue that the problem is structural, causing a shift towards the maintenance of interpersonal relationships at the expense of compliance with group obligations. In this vein, microfinance provides empirical evidence that high levels of embeddedness pose a significant risk of collective action failure. We found that the trade-off is driven by the *ability* to enforce the loan versus the *willingness* to do so. We believe this fundamental trade-off needs to be more integrated in the conception of social collateral and group lending.

Our second substantive finding is that microcredit groups consisting of multiple spatial fragments are likely to exhibit worse economic performance. Such groups have high internal variation: high proximity within subgroups and low proximity between subgroups. Our ethnographic fieldwork suggests that this structure creates particular challenges for maintaining the overall communication and solidarity that are known to enhance group cooperation (Ostrom, 2005). We found such groups are at greater risk of splitting into factions (see also Festinger et al, 1950). Our statistical analysis also shows that as the difference between subgroup proximity and overall group proximity increases, economic performance continues to decline. We believe that increased attention to the variation in subgroup structure holds significant value for understanding social collateral.

The structural embeddedness framework is one of many approaches that can be used to explore social collateral. Here, we consider the contributions and limitations of our study in context of the substantial interdisciplinary research on economic cooperation in groups. We begin by considering alternative explanations for the empirical results, in particular: (1) selection effects and (2) peer monitoring. We argue that while these mechanisms may play a role in shaping group performance, our data

analysis suggests that structural embeddedness has a distinct effect on economic behaviour.

First, one may question whether the empirical relationship we found is primarily a result of selection of members with particular individual characteristics during the group formation process. Perhaps the groups that are more spatially dispersed underwent a more rigorous selection process. Spatially-dispersed groups would have stronger average group members and the spatially-concentrated groups would have weaker average members as a result of simply choosing neighbours out of convenience or lack of options. Our ethnographic data suggested the opposite trend during the group formation process. The most common cause of spatially-dispersed groups is group leaders having limited options and going through referrals to seek out members that they do not know directly. It appears that spatially-dispersed groups have less information on potential members and undergo a less rigorous screening process. Furthermore, we found no statistical evidence that groups that were spatially-dispersed resulted in stronger average group members in terms of financial strength: monthly sales and business equity. While our data do not allow us to consider all the dimensions that a borrower may select a potential group member on, for example an individual's entrepreneurial motivation, our research suggests that structural embeddedness provides a stronger fit with the empirical data than an explanation based on selection effects regarding individual characteristics.[12]

Second, we consider an alternative explanation of economic behaviour in small groups based on peer monitoring. In this view, social relationships primarily serve as an

[12] In contrast, selection based on relational factors does play a notable role in the embeddedness perspective advanced in this paper. For example, trust resulting from a prior history of multiplex relationships is a key determinant of a group's embeddedness. For further analysis of the group formation process, see Author citation (2014).

increased means of monitoring members' financial choices and potentially influencing members' economic behaviour (Stiglitz, 1990). While our research did indicate that social interaction can play such a role, this is only a partial account of its effect on economic action. If structural embeddedness primarily provides increased opportunities for monitoring, we would expect to see the best performance from groups with high spatial concentration. However, we found that performance consistently deteriorates with the highest levels of spatial concentration. This empirical result is not explained well with peer monitoring as the driving mechanism. The empirical trend combined with our ethnographic data suggest that a reduction in willingness to enforce a group lending contract because of overriding social interests provides a stronger explanation of low performance in high-concentration groups.

This somewhat counterintuitive finding that the highest levels of spatial concentration actually produce lower levels of economic performance may be complementary to recent research on the effects of social and spatial homogeneity on cooperation. Whereas the majority of literature on cooperation suggests that social and spatial homogeneity is more likely to produce cooperation (see e.g. Rutten, Westlund & Boekema, 2009), other work has suggested that segregation and diversity actually play a critical role in maintaining cooperative behaviour (Macy & Skvoretz, 1998; Hanaki et al, 2007). In a spatially-concentrated or highly-connected social group, the risk of a defector influencing the behaviour of others is higher. This view emphasizes that a social structure which limits the exposure of potential defectors can improve cooperation rates overall (*ibid*). Our study offers some empirical evidence that high-concentration groups may not produce the best cooperation rates.

We note that this theory raises an interesting empirical puzzle for our findings on groups with spatial fragments paying more days overdue. Should spatial fragmentation

reduce the risk of negative social influence spreading throughout the group and thus improve performance? We found evidence from our ethnographic research that while groups with spatial fragments perform worse on average in terms of days overdue, they do not actually have a higher risk of full default. This suggests that spatial fragmentation may cause the group to socially splinter, resulting in reduced performance (i.e. more late payments), but that fragmentation may also stop the group from collapsing completely (i.e. loan default). Based on our sample size and the infrequency of default, we were not able to statistically test for such effects. However, additional research focusing on the longitudinal progression of microcredit payments could offer interesting insight into the dual effects of group homogeneity on cooperation rates.

Another strand of interdisciplinary research is making extensive use of experimental and simulation-based research methods to disentangle the social mechanisms underlying cooperation. Studies, such as Fehr and Gintis' (2007) experimental analysis on the effects of punishment and Nowak and Sigmund's (2005) theoretical models on the effects of indirect reciprocity, offer valuable insight to isolating social mechanisms affecting the evolution of cooperative behaviour. We suggest that empirical field studies such as this one provide a useful and necessary testing ground for the findings of such experimental work. Our analysis suggests that individuals may systematically refrain from punishing defecting group members because of high levels of embeddedness. How relevant such behaviour is to cooperation theory is difficult to assess through purely laboratory-based research. Microfinance field studies offer fertile ground for testing such issues.

Finally, we consider the contribution of this study to the microfinance literature directly focused on joint-liability lending. Initial empirical analyses of social collateral often produced inconsistent findings; basic measures of social cohesiveness were found

to have positive, negative, or no effect on loan repayment (see e.g. Zeller, 1998; Wydick, 1999). The build-up of such results has motivated some researchers to revisit the theoretical framework for social collateral and call for more fine-grained empirical analysis (Hermes & Lensink, 2007; Paal & Wiseman, 2011). This study offers a contribution by distinguishing additional variation in group substructure and by explicitly integrating the positive and negative effects of a group's embeddedness on social collateral. The empirics show how embeddedness over a continuous range can both promote and hinder loan repayment.

Our research builds on Karlan's (2007) "Social Connections and Group Banking." In contrast to our findings, Karlan found a positive linear relationship between increased spatial concentration and improved economic performance. However, we do not think that our finding of a nonlinear relationship is contradictory. Karlan's study was based on groups that were quasi-randomly assigned, as opposed to groups that were self-selecting as in our study. As such, it is likely that Karlan's study did not have as great a proportion of highly embedded groups as is common in group lending models based on self-selection. If we restrict our dataset to exclude highly concentrated groups, for example, excluding groups with mean distance less than 500 meters (see Figure 4.4), we find a positive linear relationship of spatial concentration with repayment similar to that found by Karlan (2007). Our study offers additional insight into the full spectrum of structural embeddedness and warns of the economic risks of microcredit groups becoming overembedded.

In summary, when small groups are faced with a shared economic outcome, structural embeddedness produces a tension between ability to cooperate and willingness to enforce. A more structurally-embedded group possesses several theoretical mechanisms for enhancing group cooperation. However, if the social relationships

outweigh the financial interests, the group's overall economic performance may suffer. While the benefits of embeddedness are more intuitive and widely acknowledged, the risk of overembeddedness for economic cooperation is less expected and deserving of further research.

4.8 Appendix

Table 4.6: Robustness of Model Selection and Additional Diagnostics

	Model A1		**Model A2**		**Model A3**		**Model A4**	
	Days Overdue		Log Days Overdue		Censored Days Overdue		Hazard Loan Default	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Spatial Structure								
Spatial Concentration	12.197**	(4.194)	.178***	(.052)	8.995***	(2.635)	.632**	(.258)
Spatial Concentration Squared	5.147*	(2.165)	.071**	(.027)	3.478*	(1.371)	.276†	(.136)
Spatial Fragmentation	36.689**	(12.545)	.371*	(.154)	25.205**	(7.908)	1.440***	(.421)
Spatial Concentration x Fragmentation	-47.416*	(19.994)	-.484*	(.246)	-37.269**	(12.643)	-2.060**	(.680)
Group Characteristics								
Group Size	1.176	(7.360)	-.129	(.090)	-2.903	(4.609)	.518	(.536)
Proportion Female	9.512	(14.292)	.175	(.176)	7.582	(9.047)	1.240	(.986)
Proportion Married	26.630	(21.854)	.392	(.268)	21.560	(13.709)	2.490*	(1.330)
Average Children	-1.080	(3.523)	-.060	(.043)	-2.276	(2.206)	.028	(.194)
Financial and Loan Controls								
Included but not shown								
Constant	-46.453	(41.939)	2.140	(.515)	-31.535	(26.244)	-	-

Note: N = 741 loan observations (based on 1,884 unique group members)

*†p<.10 *p<.05 **p<.01 ***p<.001 (two-tailed tests)*

In this appendix we summarize additional analyses verifying whether the selection of the statistical model is robust and appropriately specified. We summarize analysis related to (1) distribution of the dependent variable, (2) alternative statistical models, and (3) model specification.

Distribution of the dependent variable. In the principal analysis, we used maximum days overdue for each group loan as the dependent variable (see Model A1 for a summary). The distribution has a positive skew with a higher frequency of groups paying on time. We took several steps to verify that the skewness of the distribution was not adversely affecting the model results. We calculated Cook's distance and re-ran the analysis without the observations with potential high influence; the results were not significantly changed. We performed a log transformation on days overdue to reduce the skewness of the distribution. See Model A2 for regression results using log days overdue. The results are substantively the same.

Alternative statistical models. In the principal analysis, we treated the dependent variable as a continuous measure. One could question whether early payment and default should be treated differently from 'ordinary' days overdue. To account for this we considered two different models. We modelled days overdue as censored data, left censored at 0 (early) and right censored at 180 (default). Model A3 presents the results of the Tobit model. The results are substantively the same. Alternatively, one could disregard days overdue and focus on the risk of default as the key indicator of economic performance. We modelled this alternative with the Cox proportional model for discrete-time survival (the hazard rate of default over each loan cycle.) Model A4 indicates that the effects of the explanatory variables are not substantively different. Of the alternative models in this appendix, we prefer Model A1 for its theoretical motivation (i.e. interest in days overdue) and ease of interpretation.

Model specification. We note additional tests to verify that Model A1 is appropriately specified. Calculation of generalized variance inflation factors (maximum value 5.63) for the principal model indicates that multicollinearity is not a significant concern. However, we do see from the empirical results (Table 4.5) that the controls for some loan officers are highly significant; notably, Loan Officers 2 and 4 are associated with worse performing groups. To test whether loan officers were influencing our results, we divided the dataset into two subsets (one with Loan Officers 2 and 4, and one with the others). Re-running the principal model on the subsets did not significantly affect the results.

Table 4.7: OLS Regression Predicting the Effect of Transitivity on Microcredit Economic Performance in Sierra Leone, 2011

	Model B1		Model B2	
	Coefficient	S.E.	Coefficient	S.E.
Social Structure				
Transitivity	–	–	70.783*	(31.823)
Group Characteristics				
Group Size	-99.053*	(43.456)	-98.206*	(41.868)
Proportion Female	151.870	(121.697)	194.363	(118.791)
Proportion Married	-41.352	(143.593)	29.106	(141.920)
Average Children	6.480	(21.021)	24.046	(21.737)
Financial Characteristics				
Average Monthly Sales	60.850	(114.697)	0.818	(113.748)
Std Dev Monthly Sales	-81.462	(115.821)	-21.139	(114.832)
Average Business Equity	-109.545	(109.125)	-106.671	(105.140)
Proportion Petty Traders	64.442	(80.739)	48.570	(78.112)
Business Type Diversity	-5.575	(26.823)	-18.574	(26.494)
Loan Characteristics				
Loan Amount	31.134*	(14.452)	30.213*	(13.929)
Loan Cycle	-105.631*	(40.745)	-95.571*	(39.514)
Loan Officer 1	-195.460	(97.379)	-205.957*	(93.935)
Loan Officer 2	-218.693*	(87.387)	-200.255*	(84.597)
Loan Officer 3	-169.732*	(69.957)	-180.324*	(67.566)
Loan Officer 4	-201.282**	(65.911)	-202.648**	(63.502)
Constant	711.614*	(299.284)	611.814*	(291.804)
R^2	.428		.480	

Note: N = 67 loan observations (based on 315 unique group members)

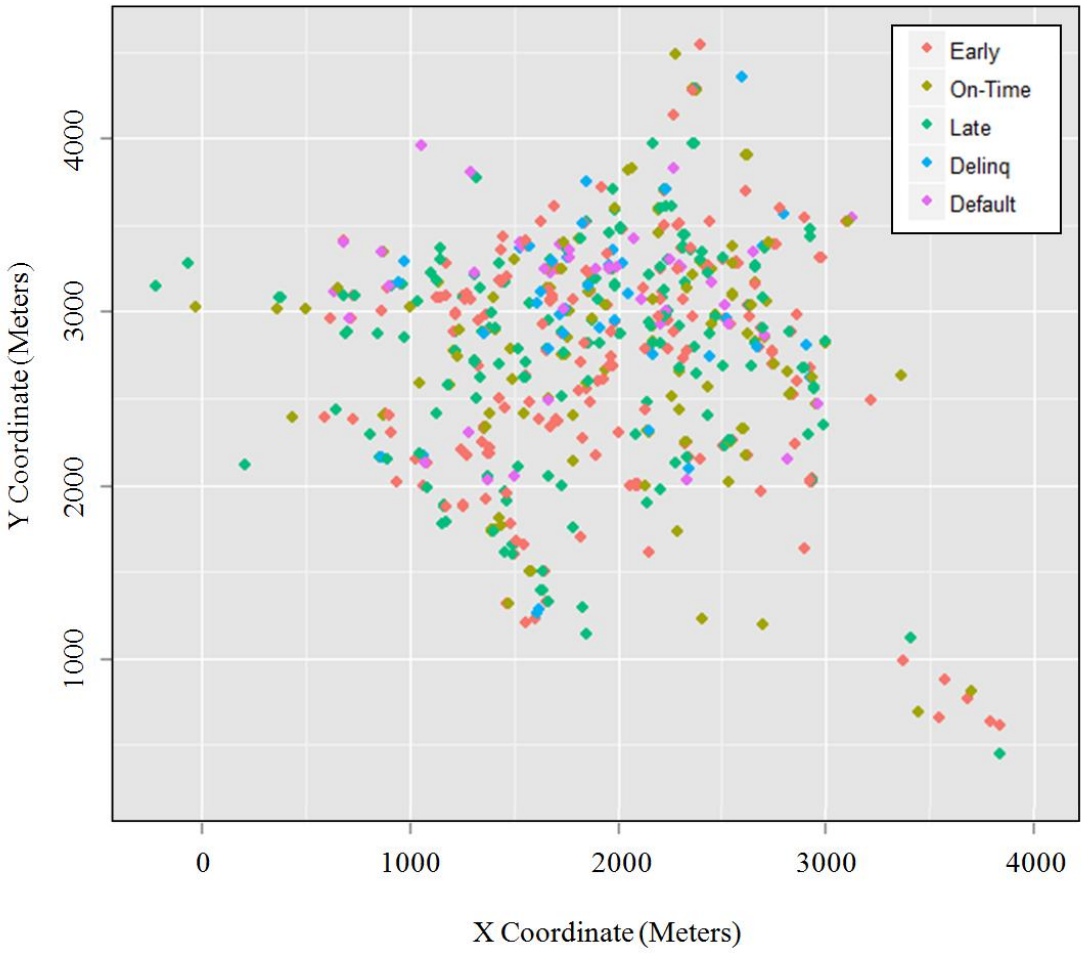
**p<.05 **p<.01 (two-tailed tests)*

In this appendix we present the results of testing the effect of structural embeddedness on economic performance using social affiliation survey data discussed previously in the Methods section. We examined transitivity within a group, a common measure of structural closure (see Wasserman & Faust, 1994). Transitivity reflects the concept that my friends are also friends with each other. We operationalized transitivity in this case as the number of closed triads over all potential triads within each

microcredit group. The measure was then mean-centred with a standard deviation of one. The effect of transitivity on economic performance was tested with the same approach as in the principal analysis using spatial structure; the dependent and control variables were constructed in the same way. The applicable sample included 315 survey respondents taking out 67 group loans. Given the smaller sample size than in the principal analysis, we were only able to test for the predominant effect of transitivity, rather than nonlinear effects and fragmentation as well. With only one loan per group in this dataset, multilevel modelling was not necessary as in the principal analysis.

Table 4.7 presents the OLS regression results. The coefficient of transitivity is positive and significant, referring to Model B2. Higher values of transitivity produce worse economic performance, suggesting that overembedded groups are more likely to perform worse in terms of loan repayment. In the principal analysis using spatial structure, we also found that higher levels of concentration produce worse economic performance on average. This provides further evidence that spatial concentration in the principal analysis is capturing a feature of structural embeddedness.

Figure 4.5: Spatial Autocorrelation of Microcredit Economic Performance in Sierra Leone, 2006-2011



Note: N = 741 group loans (1,884 unique borrowers). Colors designate group loan repayment performance.

In the text of the article we applied the Moran's I statistic for spatial autocorrelation. We found loan performance in our dataset was not spatially autocorrelated. Figure 4.5 presents the results graphically, each point representing the repayment performance on a group loan. For visual purposes, we apply five repayment categories: early, on-time, late, delinquent (30+ days overdue), and default (180+ days overdue).

5 Joint Liability Group Formation: Member Preferences through Selection Order

5.0 Abstract

This paper examines the group formation process for joint liability loans. The predominant theory of group formation for microfinance, i.e. the assortative matching of borrowers with similar risk profiles into homogenous groups, has not found empirical support in previous studies. Incorporating findings on informal risk sharing networks, this paper expands the scope of theoretical mechanisms to include social, spatial, and economic motivations. This study employs a unique methodology based on the analysis of rank-ordered selection data, which can be contrasted with most prior studies based on the analysis of resultant group composition. Selection order is modelled as a leader's revealed preferences regarding the attributes of group members using a rank-ordered logit model. The empirical data involves an original survey from microfinance clients in semi-rural Sierra Leone. The results indicate that leaders prefer members with pre-existing social ties, that are spatially proximate, and have matching business types. The preferences are stable across leaders and over subsequent decisions. No evidence is found that leaders distinguish potential members based on the financial strength of their businesses. The paper concludes that a borrower's emphasis on socio-spatial factors may be financially motivated by reducing the risk of strategic default by group members.

5.1 Introduction

Joint liability group lending has been a widespread feature of the modern microfinance movement (Morduch, 1999). Instead of offering loans to individual clients, microfinance institutions (MFIs) often provide joint liability loans to groups of clients. If one or more borrowers default, the remaining group members are held financially responsible (see e.g. Besley & Coate, 1995). However, there is an ongoing debate regarding what mechanisms underlie joint liability and, therefore, whether it is a necessary feature of modern microfinance (Attanasio et al, 2012; Giné & Karlan, 2014).

The general intuition is that group lending leverages the social relationships between borrowers in order to gain information on or influence the behaviour of clients in a way that is not possible for the lending institution to do directly. Specifically, it has been argued that group lending can improve lending efficiency by overcoming four common challenges faced by MFIs in developing economies: (1) adverse selection via peer screening (Varian, 1990; Ghatak, 1999), (2) moral hazard via peer monitoring (Stiglitz, 1990), (3) costly state verification via peer auditing (Ghatak & Guinnane, 1999), and (4) limited enforcement via peer sanctioning (Besley & Coate, 1995).

With the exception of peer screening, all these mechanisms focus on group lending ex-post, i.e. after the loan has been disbursed to the group. The issue that groups are most commonly formed through a self-selection process has received relatively little research attention (Sadoulet 1999; Berhane, Gardebroek & Moll, 2009). Additional analysis of the formation process is critical for several reasons. First, the most-cited theoretical literature on group formation for microfinance predicts that borrowers will sort themselves into groups of homogenous risk profiles (Varian 1990; Ghatak, 1999). However, almost all the empirical studies on this topic have not found support for assortative matching; rather, the studies indicate that self-formed groups typically

consist of heterogeneous risk profiles (Sadoulet & Carpenter, 1999; Lensink & Mehtreab, 2002; Berhane et al, 2009). This suggests that our current conception of the formation process is inaccurate or incomplete. Second, the endogenous nature of the formation process can produce analytical problems for ex-post research attempting to relate group characteristics to performance (Karlan, 2007). A better understanding of the formation process could be used to mitigate such endogeneity problems in future research. Third, the mechanisms driving group formation determine who gains access to microfinance services. Understanding who is invited to a group and who is excluded offers practical insight into whether group lending programs are reaching the target population (Banerjee et al, 2013).

This study empirically investigates social and economic mechanisms that potentially affect the joint liability group formation process. The research design employed makes two unique contributions to the current literature on joint liability microcredit groups. First, this paper considers a broader range of theoretical mechanisms, beyond the screening or matching of risk profiles, that may be driving the group formation process. The study incorporates relevant findings on informal risk-sharing networks and formation of community-based organizations in developing economies (Weerdt, 2002; Fafchamps & Lund, 2003; Attanasio et al, 2012; Arcand & Fafchamps, 2012). This paper considers relational factors, such as social and spatial proximity, as well as individual factors, such as a borrower's business value. Second, this paper provides a different type of empirical data more directly targeted at the *process* of joint liability group formation than has been used in previous studies. Instead of analyzing the composition of groups that result from self-selection (see Sadoulet & Carpenter, 1999; Lensink & Mehrteab, 2002; Berhane, Gardebroek & Moll, 2009; Ahlin, 2009), this paper uses data on the actual selection process. In particular, selection order

serves as revealed preferences regarding the traits of potential group members. The empirical data involves a fine-grained survey of 140 joint liability clients in semi-rural Sierra Leone. The data is analyzed using a rank-ordered logit model (Beggs, Cardell & Hausman, 1981) appropriate for distinguishing preferences based on selection patterns.

The results indicate that leaders prefer members with a pre-existing social connection and that are spatially proximate. There is also evidence of early selection of borrowers based on gender, matching business type, and number of children, potentially a signal of lack of mobility (Armendáriz & Morduch, 2010). The preferences appear relatively stable across leaders and over subsequent decisions. However, the analysis produces no evidence that borrowers with financially stronger businesses are likely to be selected early. The results draw attention to the idea that socio-spatial variables are not minor frictions to the group formation process, but may be primary forces. I conclude that the use of socio-spatial criteria may be predominately financially motivated. Potential borrowers debating a group contract often focus their attention on mitigating the risk of strategic default by group members. By introducing elements such as personal trust and a strong interest in future relationships, socio-spatial factors are the most readily available means for reducing the risk of strategic default.

The article is organized as follows. Section 2 summarizes the existing theoretical and empirical studies relevant to the joint liability group formation process. Section 3 introduces the rank-ordered logit model for analyzing selection order data. Section 4 details the empirical data and hypothesized relationships. Section 5 reports the regression results. Sections 6 and 7 close with a discussion and conclusion.

5.2 Joint liability Group Formation Literature

This review of the relevant literature is divided into four parts. The first two subsections concern key theories in the microfinance literature. The third section reviews the empirical results using microfinance data. The fourth section broadens the scope beyond microfinance to other relevant research in economic development: informal risk-sharing networks and matching in development-focused organizations.

5.2.1 Assortative Matching Theory

Most theoretical models on joint liability group formation assume that assortative matching of borrower types occurs. The work of Ghatak (1999) and Van Tassel (1999) is often cited for their demonstration of how assortative matching can improve the efficiency of the lending institution and enhance borrower welfare. In these models, an adverse selection environment is assumed in which the lending institution does not know the riskiness of potential borrowers, but borrowers have full knowledge of each other's riskiness. 'Riskiness' in these models is conceptualized as the probability of success of each borrower's investment project (Ghatak, 1999; Van Tassel, 1999). The basic argument is that if borrowers sort into homogenous groups of either safe or risky borrowers, despite being charged the same *nominal* interest rate by the lending institution, the risky borrowers receive a higher *effective* interest rate because their partners are more likely to fail and burden them with additional repayments. This occurrence then induces safe borrowers to stay in the market and reduces the overall equilibrium interest rate.

Ghatak (1999) supports this argument through construction of the 'group formation game.' In this game two types of borrower profiles exist: safe and risky. These two profiles have different probabilities of success and are fully known to the other

borrowers before group formation occurs. The model then assumes that group formation occurs such that Becker's (1993) optimal sorting property is satisfied: borrowers not in the same group should not be able to form a group without making at least one of them worse off. Allowing for the additional assumptions that borrowers are risk neutral, project returns of group members are uncorrelated, and loan enforcement is costless, it follows that assortative matching induces more safe borrowers to stay in the market and improves average repayment rates.[1]

5.2.2 Intra-Group Insurance Theory

An alternative theory to assortative matching is intra-group insurance theory. Assortative matching theory suggests that groups of heterogeneous risk profiles should only occur as a result of matching frictions (Ghatak, 1999; Van Tassel, 1999). Such matching frictions may include: imperfect information, the unavailability of partners with the same risk characteristics, and the inability to enforce on or monitor group members ex-post (Lensink & Mehrteab, 2002). Alternatively, intra-group insurance theory argues that heterogeneous groups of borrowers are likely to occur not as a 'second best,' but as the preferred choice even in the absence of matching frictions (Sadoulet, 1999).

Sadoulet (1999) argues that heterogeneous group formation could be the optimal choice because of intra-group insurance benefits. Microfinance programs often exist in developing economies where the insurance market is missing. In such situations, risky borrowers and safe borrowers may choose to join the same group. In this argument, the insurance benefit is not through a reduction of covariance risk, e.g. members having

[1] Van Tassel (1999) developed a similar theoretical argument to Ghatak (1999) for assortative matching. Their models differ in that Ghatak allows for a general distribution of borrower types and arbitrary group sizes, whereas Van Tassel allows for variable loan sizes.

different businesses with uncorrelated returns. Rather, the safe borrower's lower absolute risk is transferred to the risky borrowers in exchange for a side payment (Sadoulet & Carpenter, 1999). The risky borrower benefits from the safe borrower's ability to cover the repayments if his or her project fails. The safe borrower benefits through a tangible payment for providing this insurance. The logic follows that if such intra-group insurance is a driving mechanism of group formation, groups with heterogeneous risk profiles will occur in equilibrium.

5.2.3 Group Formation Empirical Research

Most empirical research on joint liability group formation has focused on validating whether groups have homogenous or heterogeneous risk profiles (see Sadoulet & Carpenter, 1999; Lensink & Mehrteab, 2002; Berhane, Gardebroek & Moll, 2009; Ahlin, 2009). The studies have predominately found evidence for the formation of heterogeneous groups, indicating the theory of assortative matching may not be empirically relevant (Sadoulet & Carpenter, 1999; Lensink & Mehrteab, 2002; Berhane, Gardebroek & Moll, 2009). These studies have found the existence of heterogeneous groups across a variety of contexts: urban Guatemala, semi-urban Eritrea, and rural Ethiopia, respectively.

A borrower's risk profile can be operationalized in a variety of ways and could easily influence the empirical results. The studies mentioned above have all followed Sadoulet & Carpenter's (1999) approach of measuring a borrower's risk in terms of his or her 'liquidity strategy.' Specifically, they used the percentage of expected business sales over the three days preceding a payment that a borrower relies on to make the full payment. The risk in this sense refers to the likelihood that if business preceding a due date is unexpectedly slow, how short the borrower will be in terms of using other savings to make the payment.

These studies have also accounted for the effects of matching frictions on group formation which could cause one to erroneously reject the assortative matching theory. Matching frictions have been conceptualized as limited partner availability, limited information restricting a borrower's ability to ex-ante assess or ex-post monitor a partner, and limited ability to enforce sanctions due to social norms (see e.g. Berhane, Gardebroek & Moll, 2009). Proxies to account for such matching frictions include whether borrowers knew each other before the loan, whether borrowers know the income of their partners, whether borrowers were born in the same village, and whether borrowers participated in the same informal lending group before the loan (*ibid*). Even when accounting for such matching frictions, these studies have found that borrowers do not sort into homogenous risk groups (Sadoulet & Carpenter, 1999; Lensink & Mehrteab, 2002; Berhane et al, 2009).[2]

Given the strong empirical evidence for the formation of heterogeneous groups, do we see support for the intra-group insurance theory of Sadoulet (1999)? As formulated, the intra-group insurance theory indicates that in heterogeneous groups, the riskier borrowers provide some tangible side payment to the safer borrowers in exchange for the insurance benefit. However, no studies have found evidence of such side payments consistently occurring despite heterogeneous group formation (Sadoulet & Carpenter, 1999; Berhane et al, 2009).

We are then left with a very limited explanation of the group formation process. It appears that once they are formed, groups often consist of heterogeneous risk profiles, but we have very little explanation as to what mechanisms actually motivated partner

[2] One study (Ahlin, 2009) has found empirical support for moderate homogenous sorting by risk type based on data from rural Thailand. However, the study does not control for social ties, leaving open the explanation that borrowers form groups based on social connections and socially proximate individuals are more similar in terms of risk profiles.

selection. I argue that our understanding of the group formation process has been limited by the narrowness of the mechanisms considered, i.e. the assortative or disassortative matching of risk profiles. Other potential criteria beyond a borrower's individual liquidity strategy need to be considered as primary determinants of a member's selection for a joint liability group. I turn now to the related literature on the formation of networks for informal risk sharing and attribute matching in development-focused organizations. Research on these topics posit several mechanisms that could offer greater insight to the formation of joint liability groups in microfinance.

5.2.4 Informal Risk Sharing

There is a substantial body of research focused on the endogenous formation of informal risk-sharing networks in developing economies (see e.g. Fafchamps & Lund, 2003; Murgai et al, 2002; Weerdt, 2002; Fafchamps & Gubert, 2007). This literature focuses on the question of who pairs with whom to share risk when there are no formal means of enforcement. This topic is particularly relevant to the formation of joint liability groups in which loan enforcement is expected to be primarily left up to group members.

As was posited in the joint liability group formation literature, one could expect that networks for informal risk sharing are formed on the basis of purposeful diversification of income risk. This view would suggest that risk would be minimized by reliance on network partners with uncorrelated incomes, potentially resulting from different occupations or geographic distance (Fafchamps & Gubert, 2007). However, several studies have empirically explored this topic and found that diversification of income risk is not a primary determinant of risk-sharing network formation (Murgai et al, 2002; Weerdt, 2002; Fafchamps & Gubert, 2007). Rather, these studies suggest that risk sharing is primarily determined by factors related to social and spatial proximity.

Weerdt (2002) found that kinship, geographic proximity, religious affiliation, and the number of common friends were the strongest predictors of forming a risk-sharing relationship in a rural village in Tanzania. Similarly, Fafchamps & Gubert (2007) found geographic proximity, which they expect to be correlated with kin, to be a key determinant of network formation in the rural Philippines.

The literature posits three main reasons why individuals would choose to share risk with partners that are socially and/or spatially proximate. First, such relationships provide smoother information flows (Weerdt, 2002; Fafchamps & Gubert, 2007). This provides for stronger information ex-ante to assess the individual and can be expected to provide easier monitoring and state verification ex-post. Second, socially proximate relationships facilitate trust (Weerdt, 2002; Karlan, Mobius, Rosenblat & Szeidl, 2009). A relationship with a positive personal history can provide a strong indication that the partner is not likely to exploit the relationship in the future. Third, enforcement on socially and spatially proximate partners is facilitated (Murgai et al, 2002; Weerdt, 2002). Such proximity often provides reliable social norms and enhances the ability to punish disruptive behaviour.

Similar findings have been produced by studies on trait matching in community-based organizations in Burkina Faso and Senegal (Arcand & Fafchamps, 2012) and self-help groups in Kenya (Fafchamps & La Ferrara, 2012). The results suggest that the matching process is not driven by maximizing economic gains, but rather socio-spatial factors. Experimental analysis in Zimbabwe produced similar findings for participation in a simple gamble-choice game (Barr, Dekker & Fafchamps, 2012).

In sum, factors that are often characterized as matching frictions in the joint liability group formation literature, such as social and spatial proximity, are considered

primary determinants of who matches with whom in the literature on risk sharing networks and matching in development-focused organizations.[3]

5.3 Modelling Group Member Selection Order

What mechanisms underlie joint liability group formation? One key element for understanding the formation process is the group leader's valuation of potential members. This study is motivated by the idea that the actual selection order of members can be treated meaningfully as revealed preferences regarding member characteristics. For example, a group consists of members: A, B, C, D, each with particular traits. The difference between selection order B, A, C, D and selection order D, C, B, A encodes valuable preference information. The ordering offers insight as to how group leaders combine multiple characteristics of potential members into overall evaluations of their desirability. This approach enhances prior research on joint liability group formation, in which these rank orders would be indistinguishable based on the analysis of resultant group composition (e.g. Sadoulet & Carpenter, 1999; Lensink & Mehrteab, 2002; Berhane et al, 2009).

To exploit the selection order data, the rank-ordered logit model proposed by Beggs, Cardell, and Hausman (1981) is employed. The model is a generalization of McFadden's conditional logit regression model (1974). The rank-ordered logit model is sometimes referred to as the 'exploded logit model' because it decomposes the selection order into a series of choices: first the highest valued option is selected from all the alternatives; then the next highest option is selected from the remaining alternatives; and continues until selecting between two remaining alternatives (Allison & Christakis,

[3] A notable exception in the microfinance literature is Berhane et al (2009) suggesting that trust-based social networks seem to underlie group heterogeneity.

1994). Interviews with over 60 microfinance clients in Sierra Leone motivated the assumption that selection order reflects a leader's preferences.[4]

The model formulation follows on Punj and Staelin (1978). Consider each group leader i to have a choice set $\{C_i\}$ consisting of J_i potential group members. Each member j has associated with him or her various characteristics. These individual member characteristics are denoted m_j, such as the monthly sales of the potential member's business. Denote relational characteristics between the group leader and potential member as r_{ij}, such as the geographic distance between their residences. Denote individual leader characteristics as l_i, such as the leader's gender. Assume that leader i has a certain utility U_{ij} for each member j that is some function of the member, relational, and leader characteristics represented by

$$U_{ij} = U(m_j, r_{ij}, l_i). \tag{5.1}$$

Selection order is not a direct measure of utility U_{ij}, although it is assumed that leader i will select member j before member k whenever $U_{ij} > U_{ik}$. The formulation follows a random utility model such each U_{ij} is the sum of a systematic component u_{ij} and a stochastic error term ε_{ij},

$$U_{ij} = u_{ij} + \varepsilon_{ij}. \tag{5.2}$$

The ε_{ij}'s are assumed to be independent and identically distributed with an extreme value distribution (Luce, 1959). The u_{ij} term can be further decomposed into a

[4] One could consider alternative approaches for modelling the group formation process, such as search-theoretic models (Rogerson, Shimer, & Wright, 2004) or non-expected utility theory models (Starmer, 2000). The approach taken in this paper rests on the assumption that selection order predominately reflects a leader's preferences. Interview data motivated this assumption by consistently indicating that leaders value particular traits and typically seek them out first, e.g. "I begin by looking for peoples with trust and seriousness" and "I asked her to come first because I can rely on her . . ." The proposed random utility model is intended to serve as a useful approximation of a more complex phenomenon.

linear function of explanatory variables with coefficients expressing the direction and weight of the characteristics,

$$u_{ij} = \beta m_j + \gamma r_{ij} + \theta_j l_i. \quad (5.3)$$

where β, γ, and θ denote respectively the member, relational, and leader coefficients to be estimated. The method of estimation is maximum likelihood.

Based on the this formulation, one can calculate the probability, π_{ij}, that member j is selected earlier than alternative members 2, . . . , J.

$$\pi_{ij} = \Pr\{U_{i1} > \max(U_{i2}, \dots, U_{iJ})\} = \frac{\exp(U_{ij})}{\sum_{j=1}^{J} \exp(U_{ij})} \quad (5.4)$$

The rank-ordered logit model includes the independence from irrelevant alternatives (IIA) assumption (Allison & Christakis, 1994) that the ε_{ij} terms are independent across items. We probe this assumption in the empirical section by examining the stability of leaders' preferences over subsequent decisions.

In the following section, the analysis draws on empirical microfinance data to estimate the factors which determine U(m_j, r_{ij}, l_i) based on the observed selection order of members.

5.4 Data

The empirical analysis uses survey data collected through a microfinance organization in the Northern Province of Sierra Leone (see Sabin & Reed-Tsochas, 2014). The organization is primarily involved in providing joint liability loans to small groups, ranging from three to five borrowers. All groups involved in the survey are located in the city where the organization is headquartered. The city has a population of roughly 100,000 residents spread over 16 square kilometres. The typical amount of a group loan through this organization ranges from 1.2 million to 7.5 million Leones (SLL), with each borrower receiving between 300 thousand to 1.5 million SLL. In USD,

each borrower was receiving approximately $70 to $345 USD at the time of data collection. Members of the same group receive the same amount. Note that all borrower traits in this study were collected before the first loan disbursement was made. This mitigates the risk of belonging to a particular group affecting the explanatory variables of interest.

5.4.1 Dependent Variable: Rank-Ordered Selection

Groups are formed through a self-selection process. Potential clients of the organization that are interested in taking out a micro-loan are instructed by the organization to form a group of borrowers with which they are comfortable entering into a joint liability contract. Borrowers are fully informed as to how their repayment behaviour and access to future loans will be assessed as a group and are instructed to select members accordingly. However, the organization does not allow members of the same group to be direct kin. Furthermore, each borrower must have his or her own business, roughly deemed capable by the loan officer of supporting repayment of the loan.

In this context, group formation follows a highly consistent process: (1) A potential borrower approaches the lending institution for a loan; he or she is informed that to receive a loan, a group of five borrowers is needed. (2) The potential group leader initiates the search process for members. (3) Members are invited to join the group one by one, primarily at the discretion of the group leader, until the lending organization's minimum group size requirement is met. Support for the prevalence of this stylized process is based on the researcher conducting over 60 client interviews with the primary research organization. Alternative formation processes, such as a pre-existing group applying for a loan or a non-leader member directing the selection process, are rare (94 percent of surveyed groups followed this stylized process). The consistency of the

process was further verified through interviews with four other microfinance providers in Sierra Leone. The results indicate that this formation process is not idiosyncratic to the particular lending institution.

To determine the order of membership selection, three survey sources were cross-validated for each group: the group leader, a random group member, and the loan officer. The surveys were constructed so that respondents were not required to state a selection order if it was not relevant. If a group leader indicated that the group formed through a more collective process, e.g. the members already all knew each other and decided together to take a loan, then no selection order was recorded for this type of group.

Following this procedure, 33 joint liability groups consisting of a total of 140 clients were randomly selected from the primary lending organization. The survey was conducted during 2011 and all groups had received a loan from the organization in the previous six months. Of this sample, two groups formed collectively as stated above, two groups listed contradictory selection orders, and an additional two groups produced incomplete data. These six groups are not included in the dataset. The resulting dataset consists of 119 clients constituting 27 unique groups with unambiguous selection orders.[5] Each group member received a ranking value based on the selection order, higher if selected earlier. For an illustrative five person group the data consists of: group leader, first member (value = 4), second member (value = 3), third member (value = 2), fourth member (value = 1).

[5] Ideally, we would also know the attributes of invitees that were asked to join a group, but did not accept. From this survey, declined invites were reported to be relatively infrequent. However, as the data is self-reported, it is likely to underestimate the occurrence.

5.4.2 Explanatory Variables: Spatial Proximity

It is expected that group leaders prefer spatially proximate group members for several reasons. First, information flows more smoothly between proximate members, which is useful both for ex-ante assessment and ex-post monitoring and loan repayment coordination. Second, in this context in which client mobility is fairly low, spatial proximity is often correlated with social proximity. Ceteris paribus, spatially proximate borrowers have often known each other for a longer time, have more friends in common, and have more mutual social affiliations (Sabin & Reed-Tsochas, 2014). These factors are likely to increase trust and willingness to enter a joint liability contract together. Third, spatial and social proximity enhances the group leader's ability to enforce the contract through the use of social norms and pressure. All of these factors pose mechanisms suggesting that the more spatially proximate a member is to the group leader, the more preferred he or she will be.

GPS spatial data was collected for all the borrowers' residences. The variable *Distance* is the Euclidean distance between the residence of the group leader and the residence of each member. There is an additional mechanism related to spatial proximity tested for in the models. At times, group leaders may prefer a potential member that is farther away than the other members. Evidence from interview data suggests this occurs because the strength of the social tie is strong enough to overcome the distance. Distant group members that are invited to join are rarely referrals, but strong personal connections. Inviting a strong social connection benefits the leader through personal trust even though he or she may not be able to monitor the member as closely. Combined with the predominant preference for spatially proximate members, this suggests spatial proximity may have a non-linear relationship with member selection, i.e. preferred members tend to be either spatially proximate or spatially distant, but not

typically at mid-range distance. *Distance Squared* is also included in the model to test for a parabolic relationship.

Table 5.1 summarizes the descriptive statistics for the dataset. The average distance between group leaders and their members was 0.27 kilometres, with a minimum of 0 kilometres (co-location) and a maximum of 2.86 kilometres.

5.4.3 Explanatory Variables: Social Connection

It is expected that group leaders prefer members with whom they have a direct social connection predating the loan. A pre-existing relationship may serve as a basis for trust, increase the borrower's personal regard for the other member, and improve the ability to screen a borrower's credit worthiness. Nonetheless, it is common that to form a group of five members, leaders often have to resort to inviting members that they did not personally know before the loan. In such situations they often seek out referrals regarding which community member would be a reasonable choice. In this analysis, a binary measure of *Social Connection* is used, 1 denoting members that were known directly by the leader before the loan, 0 for members that the leader met via referral for the purpose of the loan. 20 percent of the invited members in this dataset were based on referrals.

Table 5.1: Descriptive Statistics

	N	Mean	SD	Min	Max
Groups	27	–	–	–	–
Group Clients	119	–	–	–	–
Leaders	27	–	–	–	–
Members	92	–	–	–	–
Spatial-Social					
Distance	92	0.271	0.442	0.002	2.864
Distance Squared	92	0.267	0.940	0.000	8.205
Social Connection (1 = Direct)	92	0.804	0.399	0	1
Economic					
Business Equity Member	92	0.751	0.256	0.200	1.550
Business Equity Leader	27	0.820	0.295	0.250	1.650
Business Equity Relational	92	0.166	0.157	0.000	0.650
Monthly Sales Member	92	0.763	0.317	0.015	1.400
Monthly Sales Leader	27	0.842	0.325	0.150	1.500
Monthly Sales Relational	92	0.153	0.143	0.000	0.650
Business Type Member: Petty Trading	92	0.728	0.447	0	1
Business Type Leader: Petty Trading	27	0.852	0.362	0	1
Business Type Member: Food Sales	92	0.065	0.248	0	1
Business Type Leader: Food Sales	27	0.037	0.192	0	1
Business Type Match (1 = Same)	92	0.630	0.485	0	1
Control					
Gender Member (1 = Female)	92	0.946	0.228	0	1
Gender Leader (1 = Female)	27	0.926	0.267	0	1
Gender Match (1 = Same)	92	0.859	0.350	0	1
Marital Status Member (1 = Married)	92	0.957	0.205	0	1
Marital Status Leader (1 = Married)	27	1.000	0.000	1	1
Marital Status Match (1 = Same)	92	0.967	0.179	0	1
Number of Children Member	92	2.772	1.563	1	7
Number of Children Leader	27	3.741	1.509	2	7
Number of Children Relational	92	1.707	1.387	0	6
Additional Dependents Member	92	0.804	1.234	0	6
Additional Dependents Leader	27	1.185	1.618	0	7
Additional Dependents Relational	92	0.946	1.360	0	6

Note: Distance in Kilometres; Equity and Sales in Millions of Leones (SLL)

Alternatively, one might expect that the use of referrals typically indicates a leader's effort in seeking out stronger potential group members. The use of social connections may indicate overreliance on pre-existing options at the cost of the group's

financial strength. Before proceeding to the rank-ordered analysis, this issue can be empirically probed by comparing the average traits of direct connections and referrals. Table 5.2 presents an analysis of variance of the two groups. It is not surprising that the direct connections are significantly closer than referrals, a mean distance of 0.21 and 0.53 respectively. However, the other significant difference is that direct connections tend to have stronger businesses than referrals, as measured by monthly sales. The F statistic is significant with a p-value < 0.05. This suggests that the use of referrals is not likely to be a first choice, but rather a result of lack of options. The hypothesized preference for direct social connections is explored further in the rank-ordered analysis when the preference for direct connections is examined while statistically controlling for differences in attributes such as business strength.

Table 5.2: Analysis of Variance - Social Connections

	Social Connection			
	Direct	**Referral**		
Variable	(mean, n=74)	(mean, n=18)	**Difference**	**F**
Distance	0.208	0.529	-0.321***	8.24
Business Equity Member	0.771	0.664	0.107	2.58
Business Equity Relational (Difference from Leader)	0.156	0.208	-0.051	1.55
Monthly Sales Member	0.798	0.620	0.178**	4.74
Monthly Sales Relational (Difference from Leader)	0.149	0.169	-0.019	0.27
Business Type: Petty Trading	0.730	0.722	0.008	0.00
Business Type: Food Sales	0.054	0.111	-0.057	0.76
Business Type Match (1 = Same)	0.662	0.500	0.162	1.63
Gender (1 = Female)	0.932	1.000	-0.068	1.28
Marital Status (1 = Married)	0.959	0.944	0.015	0.08
Number of Children Member	2.716	3.000	-0.284	0.47
Number of Children Relational (Difference from Leader)	1.676	1.833	-0.158	0.19
Household Dependents	0.689	1.278	-0.589*	3.38

Note: Distance in Kilometres; Equity and Sales in Millions of Leones (SLL)
*p < .10 **p<.05 ***p<.01

5.4.4 Explanatory Variables: Business Equity and Monthly Sales

Each group member is required by the lending organization to have his or her own business. As an attribute variable, it is expected that members with stronger businesses would be preferred because of their greater likelihood of being able to repay the loan. Business strength is captured with two measures: business equity and monthly sales. These financial measures are estimated by the potential clients and validated by the loan officer visiting each group member's place of business. The average business equity is 750,000 SLL and average monthly sales is 760,000 SLL (approximately $175 USD) for the dataset.

Three variables are used for business equity: *Business Equity Member*, *Business Equity Leader*, and *Business Equity Relational*. Likewise, there are three variables for monthly sales. The member version is an individual measure of the potential member's business. The leader version is also an individual measure, included to test whether the leaders' characteristics may affect their preferences. The relational version is the absolute difference between the leader's business equity and a member's business equity. This accounts for the possibility that leaders are less interested in the absolute value of a potential member's business strength, but rather they prefer (or avoid) a potential member with a similar business strength. Homophily as a mechanism in group formation is well documented in the sociology literature (e.g. Cohen, 1977). This logic is also used in the creation of control variables, including both individual and relational measures.

5.4.5 Explanatory Variables: Business Type

There are theoretical reasons why selecting a group member with a similar business type could be beneficial as well as harmful. A similar business type could be preferred by the group leader because it offers greater ease in assessing/monitoring the

member's business, as well as the increased possibility of providing mutual business support/advice for each other. Alternatively, a member with a different business type could be preferred because it reduces covariance risk.

In this dataset, businesses are grouped into one of three categories: Petty Trading, Food Sales, and Other. The majority of group members (73 percent) are involved in petty trading, reflective of the type of clients that typically seek microfinance. Dummy variables are constructed for the business types, as well as a dummy variable to capture whether a member's business type matches the group leader's business type, coded 1 for match.

5.4.6 Control Variables

Controls are included for a borrower's gender, marital status, number of children, and additional household dependents. Individual and relational variables are constructed for each of these attributes.[6] Gender is coded 1 for female. Though the organization lends to both men and women, its focus is on women. Reflective of this, 95 percent of the members in the dataset are female. Marital status is coded 1 for married; note that unmarried may include single, divorced, or widowed. Of group members, 96 percent are married. The member's number of children and additional household dependents are continuous measures, with a mean of 2.8 and 0.8 respectively. Perhaps counter intuitively, a greater number of children may be preferable for a potential group member. Members with more children may be more risk averse and less mobile, potential signals of commitment to repaying (see Armendáriz & Morduch, 2010).

[6] Both versions (individual and relational) for some of the control variables are not included in the final model because of their high correlation.

5.5 Empirical Estimation

5.5.1 Rank-ordered Logit Results

Estimation begins with fitting Equation 5.5, including explanatory variables that vary over group members: member variables m_j and relational variables r_{ij}. Recall that U_{ij} denotes a leader's utility assessment according to rank-ordered selection. ε_{ij} denotes the stochastic error term.[7]

$$U_{ij} = \beta m_j + \gamma r_{ij} + \varepsilon_{ij} \tag{5.5}$$

Table 5.3 summarizes the results of the rank-ordered logistic regression and Figure 5.1 displays the predicted probabilities produced by the model.[8]

Model 1 serves as a baseline control model. Model 2 introduces the social-spatial variables. Model 3 includes economic variables without social-spatial variables. Model 4 serves as the full model.[9] The results consistently indicate that the social and spatial variables strongly affect group member selection as hypothesized. The effect of the economic variables are surprisingly insignificant, with the exception of a preference for matching business types. Controls for gender, marital status, and number of children are consistently significant.

[7] Robust standard errors are used to reduce the risk of over-interpreting effect significance.

[8] When interpreting the results, note that the estimates are based on a limited choice set, consisting only of actual group members. For example, leaders may have a strong preference for members with a pre-existing business over members without a pre-existing business. However, all alternatives in the choice set include pre-existing businesses as a result of organizational requirements.

[9] Concern of multicollinearity was analyzed with uncentered VIFs. Variables with high VIFs were removed and the models rerun. All variables in the reduced model had VIFs < 7.36 with a mean of 4.03. Substantive results were the same as those reported.

Table 5.3: Rank-Ordered Logistic Regression: Group Member Selection

	Model 1		Model 2	
Variable	Coefficient	S.E.	Coefficient	S.E.
Social - Spatial				
Distance	–	–	-8.797***	(3.199)
Distance Squared	–	–	7.256***	(2.472)
Social Connection (1 = Direct)	–	–	58.955***	(12.093)
Economic				
Business Equity Member	–	–	–	–
Business Equity Relational (Difference from Leader)	–	–	–	–
Monthly Sales Member	–	–	–	–
Monthly Sales Relational (Difference from Leader)	–	–	–	–
Business Type: Petty Trading	–	–	–	–
Business Type: Food Sales	–	–	–	–
Business Type Match (1 = Same)	–	–	–	–
Control				
Gender (1 = Female)	-0.984**	(0.487)	-0.939**	(0.451)
Marital Status (1 = Married)	-1.117***	(0.220)	-1.198***	(0.381)
Number of Children Member	0.171	(0.126)	0.369**	(0.155)
Number of Children Relational (Difference from Leader)	0.155	(0.171)	0.057	(0.174)
Household Dependents	-0.123	(0.202)	-0.145	(0.271)
Log pseudo-likelihood	-62.635		-43.364	

Note: N = 92 observations; Robust standard errors

*p < .10 **p<.05 ***p<.01

Table 5.3 (continued)

	Model 3		Model 4	
Variable	Coefficient	S.E.	Coefficient	S.E.
Social - Spatial				
Distance	–	–	-9.841**	(4.006)
Distance Squared	–	–	8.302***	(3.070)
Social Connection (1 = Direct)	–	–	56.964***	(14.897)
Economic				
Business Equity Member	1.654	(1.636)	-0.599	(2.335)
Business Equity Relational (Difference from Leader)	-1.807	(2.032)	-2.329	(2.403)
Monthly Sales Member	-2.560	(2.148)	-1.716	(2.970)
Monthly Sales Relational (Difference from Leader)	1.311	(2.118)	2.158	(2.659)
Business Type: Petty Trading	1.447	(0.631)	-1.066*	(0.544)
Business Type: Food Sales	-0.651	(0.598)	-0.041	(1.206)
Business Type Match (1 = Same)	0.173**	(0.821)	2.050**	(0.944)
Control				
Gender (1 = Female)	-1.472***	(0.383)	-1.687***	(0.436)
Marital Status (1 = Married)	-1.160***	(0.312)	-1.073***	(0.400)
Number of Children Member	0.273*	(0.165)	0.499**	(0.202)
Number of Children Relational (Difference from Leader)	0.088	(0.181)	-0.128	(0.231)
Household Dependents	-0.163	(0.212)	-0.134	(0.263)
Log pseudo-likelihood	-60.155		-40.467	

Note: N = 92 observations; Robust standard errors

*p < .10 **p<.05 ***p<.01

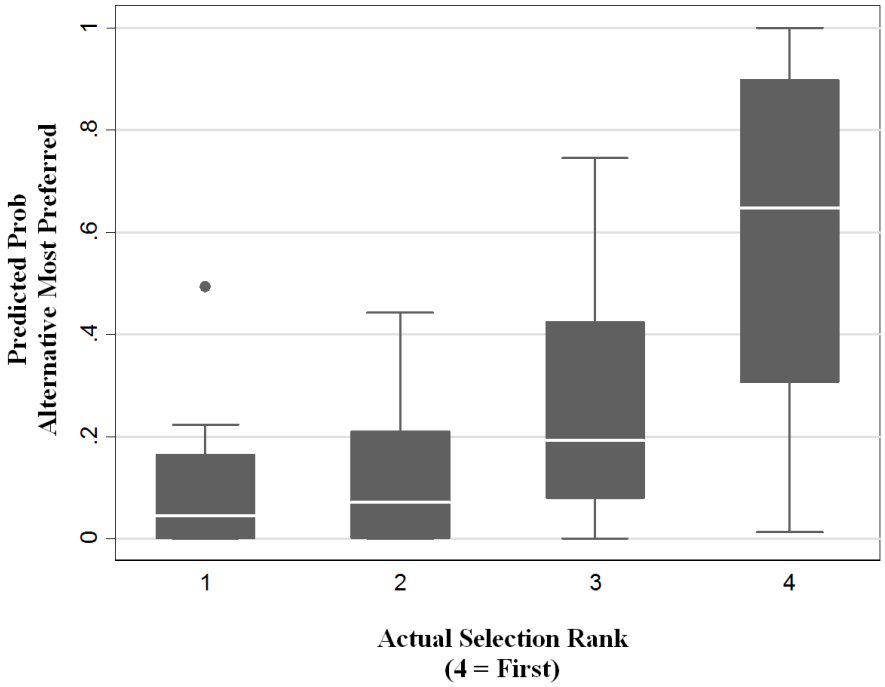
A direct social connection between the leader and invitee has the strongest effect on selection order. The effect is positive and significant with a p-value < 0.01. Ceteris paribus, having a pre-existing connection to the leader increases the likelihood that the member is selected over alternative members. Stated alternatively, leaders are less likely to prefer members known through a referral process for the purpose of the loan.

Spatial proximity has a significant effect across models with a negative coefficient for *Distance* and a p-value less than 0.01 in Model 2 and 0.05 in Model 4. The predominant effect is a preference for spatially proximate members. Increasing the distance between a leader and member by 1 kilometre decreases the odds of a member being selected over an alternative by a factor of < 0.001 (calculated as e^-9.841), holding the values for the other alternatives constant. This result is consistent with the hypothesized mechanisms in the previous section detailing the potential benefits of spatially proximate members.

As hypothesized, the coefficient for *Distance Squared* is significant and positive with a p-value < 0.01. This indicates that while the predominant effect of distance is negative, there is a significant proportion of spatially distant members that are selected early. In such cases, a distant invitee is typically a well-known person to the leader.[10]

[10] To further explore the validity of this interpretation, the relationship between the proportion of direct social connections and distance from the leader was examined. As hypothesized, the data show that the greatest proportion of social connections occur at near and far distance, with the lowest proportion at mid-distance. The difference in proportions is significant at p < 0.1.

Figure 5.1: Predicted Probabilities by Actual Selection Rank



Note: Total n = 92; n by Category 1:4 (16; 22; 27; 27)

The coefficients for the business equity and monthly sales variables were not significant as hypothesized. This is surprising and should be interpreted carefully. This result does not necessarily indicate that these variables are wholly irrelevant to the selection process. Rather, this provides evidence that they do not affect the selection order. For example, perhaps surpassing a financial threshold is necessary to be invited to a group, but the typical variation above the threshold is less important.

The coefficient of the dummy variable for a potential member's business type (1 = petty trading) is negative and significant with a p-value < 0.1. This marginally significant result indicates that engaging in petty trading decreases the likelihood that the member is selected over a member engaging in the base category. It decreases the odds by a factor of 0.344.

The coefficient for matching business types is positive and significant with a p-value < 0.05. A matching business type increases the odds of a member being selected over an alternative by a factor of 7.770. This preference may be driven by social homophily or may reflect a more financial motivation, such as an increased ability to assess the potential member's business.

The coefficient of the dummy variable for marital status (1 = married) is negative and significant with a p-value < 0.01. Being married decreases the odds of a member being selected over an alternative by a factor of 0.342.

The coefficient of the dummy variable for gender (1 = female) is negative and significant with a p-value < 0.01. This indicates that females are less likely to be selected over males, decreasing the odds of being selected by a factor of 0.185.

The coefficient for the member's number of children is positive and significant with a p-value < 0.05. An increase in one child increases the odds of a member being selected over an alternative by a factor of 1.647. This does provide support that number of children may signal a member's lack of mobility. However, this should be interpreted with caution as the number of children may be correlated with measures such as household wealth or age, which are not recorded in this dataset.

5.5.2 Stability of Preferences

This application of the rank-ordered logit model has included two assumptions regarding the stability of preferences that should be examined in further detail. First, the model assumes that leaders use the same valuation function. This assumption can be empirically tested by incorporating leader attributes, l_i, into the model.

$$U_{ij} = \beta m_j + \gamma r_{ij} + \theta_j l_i + \varepsilon_{ij} \tag{5.6}$$

This was modelled as interaction effects between leader and member attributes. It was then tested whether the slope θ_j is significantly different from zero. For example, consider that leaders with stronger businesses, measured by equity value, apply different valuation weights to potential members' attributes. A Wald test, null hypothesis that all the products of *Business Equity Leader* and member attributes have zero coefficients, produced a chi square statistic of 1.91 with 4 d.f. for a p-value of 0.752.[11] This suggests no significant effect of a leader's business equity on valuation weights. Likewise, further tests with other leader attributes provided no evidence for rejecting the null hypothesis of constant valuation weights.

The other assumption refers to the stability of preferences over subsequent decisions, previously mentioned in regards to the IIA assumption. The rank-ordered logit model formulates each subsequent decision stage as a conditional logit model in which the group leader is assumed to apply the same decision weights at each stage. One can imagine exceptions to this assumption, such as increased randomness of the selection process once one or two members have already accepted invitations. One can test the validity of this assumption by comparing the coefficients estimated with data using the first choices versus the later choices. A Hausman test was used and produced a chi square statistic of 14.06 with 12. d.f. and a p-value of 0.297. This provides no evidence of a systematic difference in coefficients over subsequent decisions.

5.6 Discussion

When borrower groups are self-formed to share a financial burden, why is the typical empirical outcome groups of heterogeneous risk profiles? The existing theoretical explanations based on assortative matching and intra-group insurance have

[11] To fit the model with an increasing number of interaction effects, it was necessary to remove less significant control variables.

not found support from previous empirical joint liability studies (Sadoulet & Carpenter, 1999; Lensink & Mehtreab, 2002; Berhane et al, 2009). To explore this question further, this study has treated selection order as revealed preferences for insight to the underlying selection mechanisms. I have drawn on a dataset that is different to previous microcredit group formation studies by (1) focusing on explanatory variables that capture both an individual borrower's financial characteristics as well as socio-spatial relational characteristics, and (2) exploring the effect on the member selection order.

The results suggest that leaders prefer members with which they have a pre-existing social connection and are spatially proximate. This supports the hypothesis that social and spatial proximity is desirable because it offers smoother information flows, increased trust, and easier enforcement. Also, more likely to be selected early are members with a matching business type and more children, which may correlate with lack of mobility or household wealth. We find no evidence that leaders systematically differentiate potential members based on variation in their business equity or monthly sales. Statistical analysis suggests that the valuation weights applied to member selection are consistent across leaders and over subsequent decisions. In prior models of microfinance in which the group formation process is based on risk profiles, socio-spatial factors are typically viewed as matching frictions (see e.g. Ghatak, 1999; Sadoulet & Carpenter,1999; Lensink & Mehrteab, 2002). However, the results of this study suggest that they are not minor frictions, but the actual engine driving membership selection.

Researchers have found empirical support for similar selection mechanisms outside the microfinance context, e.g. regarding the formation of informal risk sharing networks in developing economies (Fafchamps & Gubert, 2007). The analytical approach in this paper based on rank-ordered selection data provides complementary

evidence to the analyses based on dyadic regressions (*ibid*). Much of these empirical results are counter to what is predicted by theoretical models based on maximizing economic gains. To interpret the findings, researchers have raised the question: does matching on social and spatial variables primarily serve some sort of economic motivation or does it point towards altruistic behaviour (Bloch, Genicot & Ray, 2008; Fafchamps & La Ferrara, 2012)? I suggest that in the context of microfinance, the use of socio-spatial criteria mitigate a particular ex-ante concern: the risk of strategic default by other members. A potential group member's likelihood to stop making payments on the loan, despite the financial ability to do so, is a substantial and consistent concern of microcredit clients.

On the basis of this study's statistical data, it is unfortunately not possible to parse apart the alternative motivations that might underlie social matching. However, two additional forms of support suggest that the avoidance of strategic default is particularly important and worthy of further discussion: (1) the implications of the literature on game theory and social dilemmas (2) and the analysis of the selection processes described in over 60 borrower interviews in Sierra Leone.

Besley and Coate (1995) modelled joint liability loans in terms of a 'repayment game' that captures the issue of strategic default. Their game-theoretic analysis highlights that each borrower is faced with a choice for group contribution, emphasizing that a borrower's willingness to pay is distinct from his or her ability to pay. A joint liability contract provides an incentive for borrowers to receive a loan disbursement, strategically default, and leave the financial burden with the remaining group members. If the lending institution has limited ability to enforce the loan, then what alternative means are possible for avoiding the breakdown of cooperation by strategically defaulting group members?

An extensive literature on social dilemmas and evolutionary game theory has considered this basic problem in the more general framing of the prisoner's dilemma (see e.g. Dawes, 1980; Ostrom, Gardner & Walker, 1994). Potential solutions to this dilemma can be grouped into three broad categories: motivational, strategic, and structural (Kollock, 1998). In the context of joint liability loans, socio-spatial factors are the most ready means available to attempt such solutions. For example, if a borrower is able to enter a contract with someone whom he trusts based on past personal relationships and has an expectation for ongoing interaction, the borrower may have reduced the risk in several ways: (1) motivationally, the partner may now give some weight to the other member's outcome in contrast to a pure egoist; (2) strategically, the real expectation of ongoing interaction increases the value of a strategy based on reciprocity; and (3) structurally, the game has been changed to consider not just the terms of the loan, but to include additional social costs and potential benefits. In sum, socio-spatial factors may non-trivially affect the borrower's risk profile. Such factors raise the possibility that risk profiles should not be viewed as exogenous in group lending.

Framing group member selection in terms of setting up the game with the best chance of avoiding strategic default, fits strongly with what borrowers describe in their own words. When asked to discuss the selection process of group members, borrowers consistently return to fears of being stuck with unwilling members or, even worse, being abandoned by members that purposely flee the local area to avoid repayment. Borrowers describe selecting partners that they personally know well and trust so that even if repayment becomes difficult, a partner will still struggle to repay rather than leaving the financial burden with the group. Such concerns focus consistently on the expected *willingness* of a group member to pay.

In contrast, concerns related to the expected *ability* to pay, such as a borrower's risk profile or financial characteristics, are comparatively less front of mind for borrowers and better thought of as threshold criteria. In their own words, concerns for the financial ability of a borrower to pay are described as wanting a partner who is a serious business woman and has never been financially embarrassed. However, if such criteria are met among multiple potential members, the key differentiator is the social-spatial closeness, which is seen to reduce the risk of strategic default.

5.7 Conclusion

This study addresses the lack of empirical and theoretical congruence as to how joint liability groups form. The current theory of group formation has focused on the matching of borrower risk profiles. However, empirical studies have found self-formed groups typically exist of heterogeneous risk profiles and the studies have not suggested clear selection mechanisms producing such groups. This study poses alternative social and spatial factors, as well as economic factors, that may influence the group formation process. In order to test the relevance of such variables, this study has drawn on a unique type of empirical data. The analysis has considered how relational and attribute variables affect the selection order of members for joint liability groups in Sierra Leone. The results show that direct social connections, spatial proximity, and matching business types increase the likelihood of being selected over alternative members and may be interpreted as revealed preferences.

Over the last two decades, numerous researchers have contributed to the literature on how group lending works. A consistent question has been how social factors may influence a group's performance ex-post, such as the effect of peer monitoring on loan repayment. However, ex-ante theory on group lending has largely

neglected the social factor in group formation, theorizing it as a matching of individual financial traits. This study has attempted to address this gap and provides evidence that group members are selected primarily on socio-spatial criteria that may provide substantial economic benefit through the reduction of strategic default risk.

6 The Evolution of Economic Cooperation in Small Groups

6.0 Abstract

This study explores the evolution of economic cooperation in small groups. Over the last three decades, laboratory experiments have distinguished numerous causal mechanisms that can give rise to cooperation. However, such studies are often limited in terms of their ecological relevance. In this paper we review these findings and explore their validity in the real-world setting of microfinance. Group lending, in which a small group of borrowers are jointly liable for repaying a loan, gives rise to a natural cooperative dilemma. The empirical analysis involves 7,025 borrowers involved in 47,931 group repayment transactions over the time period from 2005 to 2011. Though the microfinance context is conducive to many of the structural, strategic, and motivational mechanisms documented in the experimental literature, we make the very interesting observation that group contribution and group effort rates consistently decline over time. This trend occurs despite selective retention of better performing groups by the MFI. As aggregate cooperation rates decline, variance across groups also increases, suggesting that stable cooperation rates have not been reached. We argue that the mechanisms of mental framing, learning, and reduced willingness to punish, help explain why cooperation decreases over years of repeated interaction. These findings enhance the broader study of cooperation by identifying the most salient factors underlying a decline in group contribution and effort rates in a large, real-world dataset.

6.1 Introduction

Does economic cooperation propagate in small groups over repeated interactions? It is widely accepted that carefully controlled laboratory experiments constitute the most direct way to distinguish between different causal mechanisms that can give rise to cooperation (Dawes, 1980; Kollock, 1998; Chaudhuri, 2011). Behavioural data generated from cooperative games, such as prisoner's dilemmas, public goods, and ultimatum games, has produced valuable insights regarding collective behaviour in the laboratory setting (e.g. Axelrod & Hamilton, 1981; Gintis et al, 2005). However, do such games accurately capture how cooperation evolves in the real world? Despite their research benefits, laboratory experiments are often limited in terms of their ecological relevance, resulting, for example, from participant bias, lack of context, small sample size, and short time frame. A richer understanding of cooperation can be developed by complementing laboratory experiments with real-world observational studies of group behaviour (Poteete, Janssen & Ostrom, 2010).

Microfinance is a particularly valuable context for studying cooperation in a real-world setting. Group lending, in which a small group of borrowers are jointly liable for repaying a loan, gives rise to a natural cooperative dilemma in a semi-controlled format. Who belongs to each group is well defined and the collective economic outcome can be directly measured. However, in contrast to most laboratory settings, the economic stakes are critical to the participants. Moreover, analysis of microfinance can provide insight to how economic cooperation evolves in a large sample over years of regular interaction.

The objective of this study is to use empirical microfinance data to explore the ecological validity of experimental findings regarding the evolution of economic cooperation in small groups. We begin by reviewing the literature on experimental games to develop expectations for how cooperation is likely to evolve in the context of

group lending. A priori it appears that group lending is conducive to most of the structural, strategic, and motivational mechanisms that have been identified as promoting cooperation. For example, the setting involves small groups with awareness of individual behaviour, shown to promote communication and reputation building (Ostrom, Gardner & Walker, 1994), self-selection of partners and the option to exclude members from future rounds, shown to enhance collective stability through selective interaction (Nowak, 2006), and the ability to (informally) punish defectors, shown to enhance norm compliance through strong reciprocity (Fehr & Gintis, 2007).

Our empirical analysis involves a microfinance dataset from Sierra Leone, detailing group behaviour from 2005 to 2011. The dataset includes 7,025 borrowers involved in over 47,931 group repayment transactions. We measure cooperation in terms of the *Group Contribution Rate* and *Group Effort Rate*, constructed from the collective amounts and timeliness of observed monthly repayments, while controlling for individual and financial factors affecting the ability to pay. The dataset allows us to test expectations regarding: (1) the overall level of cooperation, (2) systematic changes in aggregate behaviour, and (3) the stability of cooperation over time.

We find that that though cooperation rates start out high, near 100 percent, they steadily decline both within and across loan cycles, with mean cooperation rates as low as 68 percent. This is particularly notable considering that there is selective retention, by the MFI, of groups that performed well in the previous loan cycle. Furthermore, we find that even after years of monthly repayments, aggregate cooperation has not converged on a stable rate. Rather than declining, variance across groups actually increases over time.

This study raises important questions regarding how economic cooperation can be maintained in real-world settings. If microcredit groups exhibit the principal

structural, strategic, and motivational mechanisms studied in laboratory experiments, what ingredients are lacking to maintain cooperation? We suggest that over years of repeated interaction, more subtle social-psychological factors can play an increasingly important role. We suggest that the decline in cooperation may stem from mechanisms such as mental framing (Tversky & Kahneman, 1981), the dual-edged effect of learning in games (Rapoport, Daniel & Seale, 2008), and a decline in willingness to punish (Fehr & Gintis, 2007).

The article is structured as follows. Section 6.2 summarizes findings from cooperative games and develops our expectations for the evolution of cooperation in microfinance. Section 6.3 introduces the empirical data and our methods. Section 6.4 provides the empirical results. Section 6.5 discusses the findings in light of alternative cooperative mechanisms. The Appendix contains additional analysis supporting the robustness of our empirical approach.

6.2 Cooperation Theory and Experimental Findings

6.2.1 Actor Motivations

Expectations about collective behaviour are grounded in assumptions regarding how individuals are motivated. Theoretical perspectives can broadly be grouped into those built on homogenous actor motivations versus those employing heterogeneous actor motivations. Perspectives built on homogenous motivations typically assume that individuals are exclusively self-regarding.[1] Extensive laboratory experiments document that some subjects consistently make no contribution to a public good (Fehr & Gintis, 2007), offer partners nothing in the ultimatum game (Henrich et al, 2004), and do not reciprocate a partner's generosity in the trust game (Berg, Dickhaut & McCabe, 1995). Note that models of exclusively self-regarding actors are able to produce high-level cooperative outcomes under certain conditions (Nowak, 2006). This suggests that even though homogeneity can be a useful simplification for modelling group behaviour, it may also be a valid depiction of the typical individual's interests.

In contrast, those supporting the assumption of heterogeneous motivations argue that a significant number of actors are not exclusively self-regarding. Other-regarding motivations exist and play a non-trivial role in collective behaviour. As Dawes (1980, 176) notes "Few of us would accept $500 with nothing for our friend in lieu of $495 for each of us." Extensive laboratory evidence now supports this intuition that some actors should be depicted as altruists or conditional cooperators (Gintis et al, 2005). To clarify why this assumption is controversial, it is necessary to explicitly define altruists and conditional cooperators. First, Nagel's (1970, 79) definition of altruism is often used as a reference: "By altruism I mean not abject self-sacrifice, but merely a willingness to act

[1]Homogenous motivations may also involve exclusively other-regarding behaviour, though this is a much less common assumption in the cooperation literature.

in the consideration of the interests of other persons, without the need of ulterior motives." The definition clarifies a type of behaviour that does not qualify as altruism: behaviour which benefits another person, but may have been motivated by the expectation of receiving something in return. For example, expectations of reciprocity even in the distant future are not viewed as other-regarding. The challenge to validating the existence of altruism with behavioural data is that we can only disprove altruistic actions with evidence of selfish or ulterior motives (Andreoni, Hargaugh & Vesterlund, 2010).

Still, various cooperative experiments suggest that subjects have altruistic intentions. Altruism has been found in prisoner's dilemma games (e.g. Roth & Murnigham, 1978), public goods games (Andreoni 1995), and ultimatum games (Guth, Schmittberger & Schwarze, 1982). In these games, some subjects contribute more to their partners than would be expected if they were exclusively self-interested. Extensive variations of these experiments have been designed to rule out ulterior motives that would contradict altruism such as confusion, reputation, fear of rejection, and the warm-glow effect (Andreoni, Hargaugh & Vesterlund, 2010).

Let us briefly focus on one simple example, the ultimatum game, to illustrate the strength of the evidence for altruism. In the ultimatum game, two players are shown a sum of money. Player 1 proposes how to split the money and Player 2 accepts or rejects the proposal. If the offer is rejected, both players get nothing. For further details, see the seminal work by Guth, Schmittberger and Schwarze (1982). If both are exclusively self-interested, Player 1 should offer the smallest percentage possible to Player 2 and Player 2 should accept any positive offer made by Player 1. Yet, many subjects will offer larger than predicted amounts to Player 2. Is it altruism? Perhaps the larger offers are motivated by a fear of rejection. Forsythe et al (1994) created an even simpler version of

the game in which Player 2 has no ability to reject the offer. Alternatively, perhaps the larger offers are driven by concern for one's reputation. Variants have been run with anonymization of the subjects, as well as anonymity from the researchers (Hoffman, McCabe, Shachat & Smith, 1994). Perhaps the larger offers are driven by the warm-glow effect, the personal satisfaction that may arise from giving. Variants have limited the warm-glow effect by randomizing the ultimate pay-outs received by other players (Stahl & Haruvy, 2006). All these well-designed variants do find that the amount of giving that could be attributed to altruism is reduced by including the controls. Nonetheless, non-trivial amounts of giving, for example 25 percent of their endowments on average (Forsythe et al, 1994), has been associated with some form of altruism driven by inequality aversion or empathy.

Having shown evidence for actors with self- and other-regarding preferences, we now consider a final characterization that blends these motivations. Conditional cooperators refer to individuals that account for their own and others' interests when deciding to defect or not. Conditional cooperation has been studied in the laboratory setting as early as Bryan and Test (1967) and Kelley and Stahelski (1970), as well as a renewed interest led by Gintis et al (2005). Two key behaviours have been associated with conditional cooperators: contribution based on expectations of others' behaviour and altruistic punishment. The first trait highlights that if an actor has mixed motives, a key determinant of their action is how many others are likely to contribute. This consideration has been shown to result from both self-regarding interests, i.e. if a significant number of others are cooperating it can be in one's long term interests to also cooperate; and norm compliance, i.e. internalized social values regarding appropriate cooperative behaviour (Fehr & Gintis, 2007).

The second notable trait of conditional cooperators is that they often engage in altruistic punishment, meaning that even at a personal cost they are willing to punish defectors. One might suspect that punishment is self-motivated; in subsequent rounds, punished players often contribute more. However, experimental variations show that some subjects are willing to punish defectors whom they have no expectation of future interaction (Fehr & Gächter, 2002).

Why is the possibility that actors may be motivated by both self- and other-regarding interests important? According to laboratory experiments, conditional cooperators are the most common behavioural type of the categories discussed here (Fehr & Gächter, 2002; Gintis et al, 2005; Chaudhuri, 2011). If this is true, the ecological validity of research built on such assumptions will be greater. Furthermore, the collective behaviour of a group of heterogeneous actors is strongly dependent on the particular structure and context of the cooperative situation. As we will explore in the following sections, a large amount of laboratory research has attempted to identify the most important mechanisms that may promote or derail cooperation.

6.2.2 Cooperation in Voluntary Contribution Games

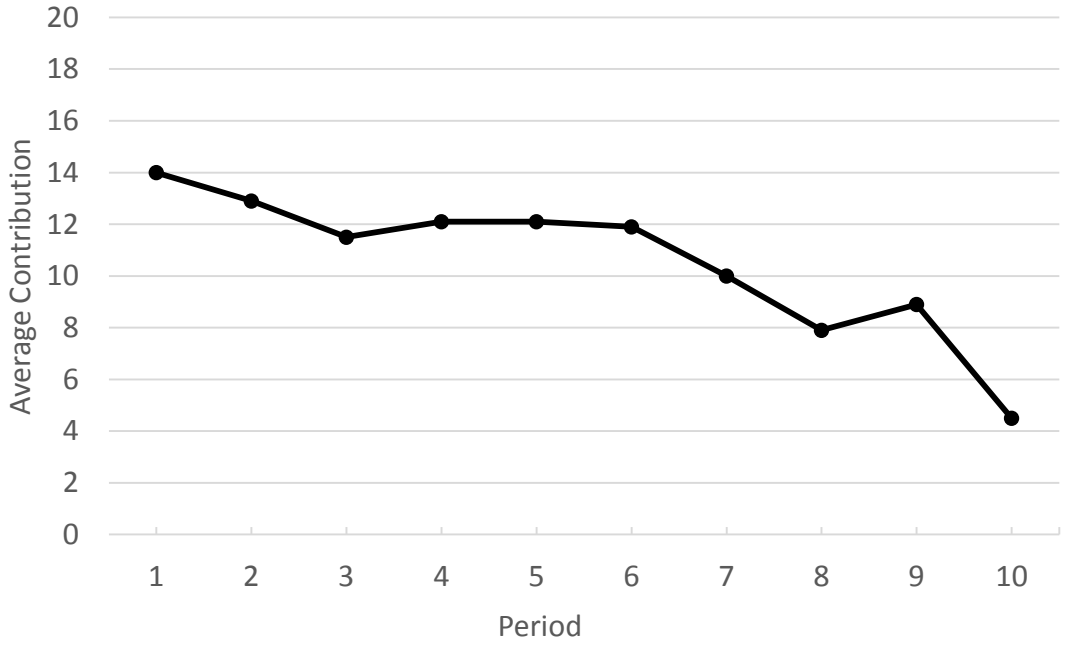
Of the many cooperation games mentioned in this paper (prisoner's dilemmas, public goods, common pool resources, ultimatum games, and trust/gift exchanges) we now focus our attention on the iterated Voluntary Contribution Mechanism (VCM) game, often used to model public goods, for its relevance to cooperation in microfinance. VCM games are particularly relevant for developing theoretical expectations of group lending for two reasons. First, our interest lies in group behaviour in which there are $N > 2$ actors. VCM and Common Pool Resources (CPR) games involve $N > 2$ actors, whereas the other games typically explore the interaction between two individuals (Dawes, 1980). Second, VCM models are often referred to as a 'giving

game' in which subjects choose to contribute to the shared account. In contrast, CPR models are often referred to as a 'taking game' in which subjects choose whether to extract from the shared account (Croson, 2010). Group lending in microfinance, in which a small group of borrowers repeatedly choose whether to contribute to the group repayment or not, is most comparable to the VCM model.

Here we provide a brief summary of the VCM game as implemented by Isaac, Walker and Thomas (1984) in their seminal study and summarize the findings produced from this 'basic' version of the game. Subjects were allocated to groups of four. In each period, the subjects are given some tokens to allocate between a private and group account. The private account earned 1¢ for each token. The group account earns 0.3¢ per token for each member, regardless of whether or not they had contributed to the group account themselves. The results are distributed and the game replayed ten times in total. This structure produces the basic tension between individual and group interests. We see that the payout to individuals for defecting, i.e. placing tokens in the personal account, is always greater than cooperating, placing tokens in the group account (1¢ > 0.3¢). However, all individuals receive a lower payout if all defect rather than if all cooperate (4*0.3¢ > 1¢).

The dilemma has been described as a situation “in which individual rationality leads to collective irrationality” (Kollock, 1998, 183). With this basic structure, the outlook for cooperation is grim. Numerous studies have produced the same substantive results (Isaac et al, 1984; Croson, 2010; Chaudhuri, 2011). Cooperation starts relatively high with 40-60 percent of tokens placed in the group account. However, cooperation steadily declines over rounds, ending with 10-20 percent of tokens in the group account. See Figure 6.1 for a typical contribution pattern with a VCM game (Croson, 2007).

Figure 6.1: Average Contributions to Group Account in VCM



Source: Croson (2007).

6.2.3 Cooperative Mechanisms

Many researchers have elaborated on the VCM model and found that the group outcome is not as negative as suggested in the basic version of the game. An extensive list of mechanisms that promote or hinder cooperation have been identified. The intent here is not to provide an exhaustive list of these mechanisms (for relevant reviews and meta-analyses see Dawes (1980), Kollock (1998), or Chaudhuri (2011)). Rather, the intent here is to develop our a priori expectations for the evolution of cooperation in the microfinance setting. Thus, we focus on mechanisms that are expected to have a strong influence on microcredit group behaviour.

To structure our review of cooperative mechanisms, we employ the categorization used by Kollock (1998). He defined three categories based on actor

motivations and the nature of the dilemma: (1) structural, (2) strategic, and (3) motivational.[2]

Structural Cooperative Mechanisms: Structural mechanisms involve how the dilemma is set up and the pay-outs associated with different actions. In Kollock's words (1998, 192), they are "the rules of the game." These mechanisms affect group behaviour even if the actors are exclusively self-regarding. Structural mechanisms include the production function (Croson, 2010), number of iterated rounds or possibility of long-term relationships (Fehr & Gintis, 2007), and group size (many studies have found that as groups increase, cooperation declines) (Komorita & Lapworth, 1982). Here, we focus on two additional structural mechanisms in further detail for their relevance to microfinance: structured interaction and ability to punish.

In the basic VCM game, participants do not know each other in advance and are randomly assigned to groups. In real social dilemmas, populations are not well mixed, interacting randomly. Rather, spatial proximity or social structures imply that some individuals interact more often than others (Nowak, 2006). Such interaction may result from exogenous factors, such as spatial constraints, or may result from endogenous processes in which actors choose whom they want to interact with. Such structured interactions can enhance cooperation by producing clusters of similar actors, reducing the interactions of cooperators and defectors. Laboratory experiments have explored this mechanism by introducing the rematching of group members between rounds (Gunnthorsdottir, Houser & McCabe, 2007; Page, Putterman & Unel, 2005). They find that both exogenously sorted groups, rematched by the researchers based on participants' prior contributions, and endogenously sorted groups, rematched by the participants'

[2] Some mechanisms are not mutually exclusive to these categories. For consistency, we follow Kollock's (1998) framework, but point out instances in which mechanisms could play multiple functions.

preferences, have a higher mean contribution rate to the group account, as compared to randomly sorted groups. Contribution rates in sorted groups were also more stable, with little or no decline (Gunnthorsdottir et al, 2007). These structural effects have also been found in research based on computation models and simulations (Macy & Skvoretz, 1998; Hanaki et al, 2007).

The other structural mechanism particularly relevant to microfinance is the ability to punish. In games, punishment is typically operationalized as a financial penalty that can be applied to defectors. Punishment in real social dilemmas may take on additional forms, such as psychological shaming or social embarrassment. Cultural norms and structural factors, such as group size and level of anonymity, determine the ability to effectively punish. Experiments consistently indicate that the possibility of punishment, which does not always have to be exercised, strongly improves cooperation (Fehr & Gintis, 2007; Chaudhuri, 2011). The change in mean contribution rate is substantial; for example, in Fehr & Gächter's (2000) study, mean contribution without punishment was 19 percent and 58 percent with punishment.

It is interesting to note that the individuals that apply the punishment may do so for very different reasons. Punishing defectors can be self-interested behaviour because defectors are more likely to contribute to the group account in subsequent rounds (Fehr & Gintis, 2007). However, as we discussed in the section on Actor Motivations, some individuals will punish defectors even when there is no possibility of material gain for themselves. This is suggestive that punishment is also motivated by internalized aversion towards defectors (*ibid*).

Researchers have also explored the relationship between punishment and the dynamic stability of cooperation. The results indicate that the greater the available penalty and the higher the frequency of punishers, the more stable is group contribution

(Chen & Plott, 1996; Boyd et al, 2010). Convergence to equilibrium contribution rates also occurred more quickly with greater punishment opportunities (*ibid*).

A related concept to punishment is social ostracism. It is worth mentioning explicitly for its relevance to microfinance, in which ostracism can be applied at the level of the lending group or more broadly at the level of the social community. Ostracism can be considered a subclass of punishment in which the structural result is severing future social interaction (Ouwerkerk et al, 2005). The concept has been applied to VCM games in which at the end of each round the group may vote to expel members (Cinyabuguma, Page & Putterman, 2006; Charness & Yang, 2007). As with studies on financial punishment, the possibility of ostracism improves cooperation rates.

Considering these structural mechanisms, what are our expectations for the evolution of cooperation in microfinance? The structure of group lending, primarily by design, includes many of the structural mechanisms found to promote cooperation in laboratory experiments. Microcredit groups in this context are small, usually five members. The groups have the possibility of numerous interactions and long-term relationships, with no formal limit on the number of loan cycles. Group formation allows for selective interaction; they are allowed to choose who they play the game with. They also have the option of deselection or ostracism. Group members may be expelled between loan cycles. There is no formal mechanism to apply a financial penalty with the group. However, the ability to apply informal penalties are widely acknowledged, e.g. public shaming or reduced likelihood of future business relationships (Morduch, 1999). The specific context of each group will determine the efficacy of such punishment mechanisms.

Thus, based on the findings from laboratory experiments, we would expect the structural mechanisms of group lending to produce high average cooperation rates, increasing cooperation rates over rounds, and convergence towards a stable equilibrium.

Strategic Cooperative Mechanisms: Like structural mechanisms, strategic mechanisms also do not require other-regarding motivations to affect cooperation. However, they do not involve changing the fundamental structure of the dilemma, but are based on strategic interactions within the existing framework (Kollock, 1998). Key strategic mechanisms for cooperation involve learning and reciprocity.

Learning how to play the VCM game is an important factor when interpreting changes in individual behaviour over rounds (Andreoni et al, 2010). Learning encapsulates an increased understanding of the rules of the game, developing effective strategies, and shaping one's expectations about others' behaviour. In the first rounds, participants' behaviour may include confusion and a limited understanding of implications for future rounds. Note that learning does not strictly imply a direction on the evolution of cooperation rates. If learning increases awareness that the greatest individual return in a single round is always to contribute nothing, cooperation rates would be expected to decline from learning. However, if learning increases awareness that contribution to the group account is socially efficient and others are likely to contribute, then cooperation rates may increase.

Reciprocity refers to returning behaviour in kind (Axelrod & Hamilton, 1981). The concept has been developed over the last three decades to distinguish three forms of reciprocity: direct reciprocity (*ibid*), indirect reciprocity (Nowak & Sigmund, 2005), and strong reciprocity (Gintis et al, 2005). As a strategy, direct reciprocity involves person-to-person observation of others' behaviour and returning cooperation with cooperation and defection with defection (Axelrod & Hamilton, 1981). Direct reciprocity functions

on the expectation of future interactions with those with whom you are currently interacting. If there is no such expectation, direct reciprocity is not an applicable strategy.

In contrast, indirect reciprocity introduces the role of reputation (Nowak & Sigmund, 2005). One may choose to cooperate with an individual, not because she expects to directly interact with her again, but because her prior behaviour will be known to future partners. Thus, indirect reciprocity can provide an incentive for cooperative behaviour if it is likely that one's reputation will be known.

Strong reciprocity refers to the propensity to cooperate conditionally and engage in costly punishment (Gintis et al, 2005). In the prior section on actor motivations, the evidence for actors engaging in costly punishment was introduced. As a strategic mechanism, punishing defectors may be pursued out of self-interest because it often increases other's contributions in future rounds (*ibid*).[3]

In general, mechanisms based on reciprocity promote cooperation by removing players from the grim outlook of a one-shot prisoner's dilemma. Experiments have shown that if the games are manipulated such that reciprocal strategies are not appropriate, such as randomly reshuffling players and obscuring past behaviour, mean contribution rates decrease significantly (Bolton, Katok &Ockenfels, 2005).

Considering these strategic mechanisms, what are our expectations for cooperation in microfinance? Note that the use of strategic mechanisms is up to the discretion of the individuals. It is more appropriate to consider whether the group lending context would make such strategies viable, rather than if such strategies will be used. Theoretically, repeated interactions are indefinite in group lending, with no

[3] Strong reciprocity may result from strategic intentions, i.e. punishing defectors for higher expected gain in future rounds, as well as a result of internalized norms regarding reciprocal fairness and inequity aversion (Fehr & Gintis, 2007).

organizational limit on the number of loans. This opens the door for learning and reciprocity. In practice, group members may have a more limited horizon in mind. In support of indirect reciprocity, the microfinance context is often characterized by group members aware of others' reputations (Morduch, 1999).[4] As discussed previously in the microfinance context, informal punishment is a possibility, but its relevance depends on the specific group's context, making the use of strong reciprocity an open empirical question.

Thus, based on the findings from laboratory experiments, we would expect that the possibility of using strategic mechanisms in group lending should enhance average cooperation rates. However, we note that the context of group lending does not allow us to predict clearly in which direction learning and the possibility of strong reciprocity will influence cooperation.

Motivational Cooperative Mechanisms: In contrast to the structural and strategic mechanisms, motivational mechanisms are based on the possibility that an actor may give some consideration to others' interests. Because these mechanisms operate by increasing the weight an individual gives to the outcomes of other people, they are particularly relevant to conditional cooperators. Recall that conditional cooperators consider both self- and other-regarding interests and the specific situation determines which choice they will make (Fehr & Gintis, 2007). Relevant motivational mechanisms include framing, communication, social norms, and group identity (Dawes, 1980).

Simple differences in how a problem is framed have been shown to have systematic effects on people's decisions (Tversky & Kahneman, 1981). For example, a group contribution game, framed as producing positive externalities on other players, can easily be recast as a taking game, framed as producing negative externalities on

[4] In small groups, reputation may be more relevant during the phase of member selection.

other players. Though the financial impact on other players may be held constant, the mental framing changes contribution rates. Individuals exhibit increased cooperative behaviour when the game is framed as producing positive externalities (Croson, 2010). This behaviour arises because different frames can trigger internalized norms regarding inequity aversion and reciprocal fairness (Fehr & Gintis, 2007). Communication has been shown to be one of the most robust mechanisms for enhancing cooperation (Dawes, 1980; Kollock, 1998). The mechanism plays two broad roles: motivational and logistical. Communication opens the possibility to influence one's personal motivation through moral suasion, enhancing group solidarity, or reinforcing social norms. However, communication does not just play a motivational role. It also plays a logistical role in promoting coordination. Talking to other players allows for information gathering and setting expectations about others' intentions (Ostrom et al, 1994). VCM games played with and without the option of communication show a change in cooperation rates on average from 30 percent to 70 percent (Dawes, 1980). Furthermore, treatments with communication produce more stable contributions over rounds (Kollock 1998; Chaudhuri, 2011).

The strength of social norms also has a substantial effect on the evolution of cooperation. Research has suggested that other-regarding preferences are not purely a result of individual motivations. Research by Henrich et al (2004), in which they repeat the same cooperative games in different countries, show that social preferences are culture-dependent. Furthermore, social norms for cooperation can be disrupted by introducing competing motivations. For example, the motivation to cooperate because of others' well-being can be disrupted by adding in monetary rewards for cooperation. A meta-analysis by Balliet, Parks, and Joireman (2009) found that when groups are faced with a social dilemma, individuals that were not paid cooperated more than those that

were paid. It is argued that by monetizing the reward for cooperating, those that may have approached the dilemma with a prosocial frame discounted its relevance, focusing on personal gain instead.

In light of the motivational mechanisms, what are our expectations for the evolution of cooperation in microfinance? At a first pass, group repayment may be framed as producing positive externalities on members. By contributing, one promotes the group's general good. However, the mental framing may be more nuanced than that: having already received and used the money, borrowers may focus on non-repayment as producing negative externalities, burdening the other members. As such, mental framing of group lending is a point of empirical inquiry. Communication in microcredit groups is generally high, but varies significantly by group depending on their social and spatial proximity. In general, the cultural norms regarding microcredit repayment in developing countries is positive. Industry-wide default rates are relatively low, less than five percent on average (Morduch, 1999).

In sum, based on the findings from laboratory experiments, we would expect the motivational mechanisms of group lending to promote high average cooperation rates. Further, we do not have any a priori expectations for the efficacy of the motivational mechanisms to decline over rounds, e.g. we do not predict a negative shift in framing or a general reduction in communication within groups. As such, we expect motivational mechanisms to increase or hold flat cooperation rates over rounds.

6.3 Data and Methods

In the previous section, we reviewed the literature on cooperative games to develop expectations for the evolution of economic cooperation in small groups. Our empirical goal is to use real-world microfinance data to test the validity of these

laboratory findings. Given the structural, strategic, and motivational mechanisms of microfinance, how does cooperative behaviour evolve over repayment rounds? To answer this question, we employ the following approach. We construct measures of group cooperation based on precedents in the experimental literature and the specific context of group lending. We then analyze and present aggregate trends in group cooperation in terms of directionality and stability. Throughout the analysis we apply statistical controls at the group-level for financial, demographic, and organizational factors to help interpret mechanisms underlying the behavioural trends.

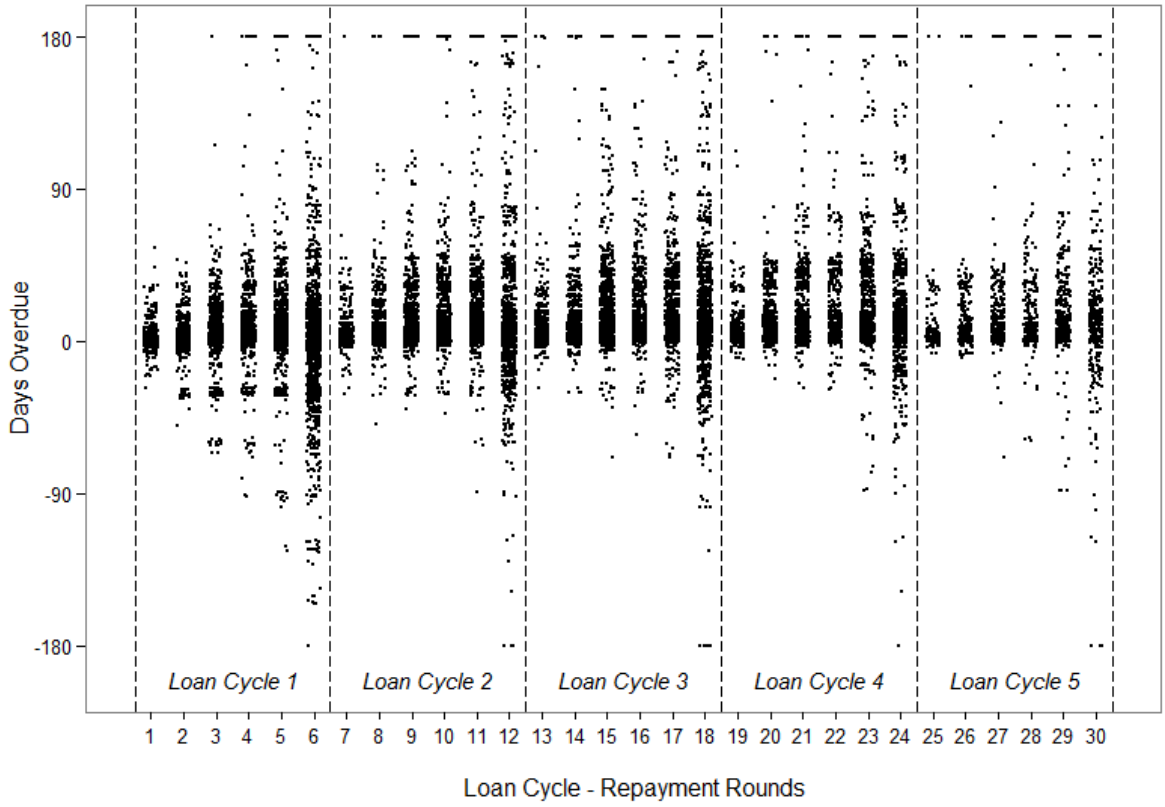
The dataset involves a microfinance institution (MFI) from semi-rural Sierra Leone. The MFI's primary service is providing small-group loans to local clients for investment in micro-businesses. The MFI was founded in 2002 and, as of 2011, had grown to service over 18,000 clients, providing additional loan types such as individual and salary-linked products. The group loans are provided under a standard joint-liability contract (see Morduch, 1999). Groups are formed through a self-selection process. Each group member receives an equal portion of the loan to invest in their own micro-business. The members are held jointly-liable such that if one member is not able to repay, the entire group is held financially accountable. For further detail on the MFI's practices, see Sabin and Reed-Tsochas (2014).

The dataset includes 7,025 borrowers constituting 1,592 unique groups. The values of the loans range from 200,000 to 2,250,000 SLL per member. At the time of data collection in 2011, the nominal exchange rate was $1 USD = 4,300 SLL. All loans have the same interest rate: 2 percent per month. All loans require monthly group payments; however, they vary in their duration, ranging from 6 to 12 months. Given the small loan amount and short duration, groups often receive multiple loans from the MFI sequentially. In this dataset the maximum number of loan cycles is five.

The principal empirical analysis involves interpreting group behaviour from recorded repayment transactions. For each group's monthly scheduled repayment, the MFI records the amount and the actual date the repayment was made. Furthermore, for each scheduled repayment the MFI records whether the payment was made in a single payment or in partial payments on different dates. For example, consider a group that is not able to repay its scheduled monthly amount of 300,000 SLL due on June 6, 2010. The group may pay 100,000 SLL on June 8, 2010 and the remaining balance of 200,000 SLL on June 20, 2010. This detail of information was recorded by the MFI in their management information system.

The usable data for this analysis begins in 2005 and continues to 2011. We do not include the years before 2005 because basic organizational standards had not yet been established. The dataset consists of 31,277 scheduled group repayments. Including partial payments, the dataset consists of 47,931 group repayment transactions. Figure 6.2 provides an overview of the repayment data in granular format. Each data point represents a group's monthly repayment.

Figure 6.2: Granular Overview of Group Repayment Data



Note: N = 31,277 group repayment transactions. Horizontal jitter (random noise) added to the repayment rounds for display purposes.

6.3.1 Group Cooperation Rates

We use the repayment data to construct two measures of group cooperation: (1) *Group Contribution Rate* and (2) *Group Effort Rate*. The Group Contribution Rate measures the percentage of the monthly scheduled amount paid by the group within 30 days.

$$\text{Group Contribution Rate} = \frac{Actual\ Amount\ Paid}{Scheduled\ Amount} \times 100 \qquad (6.1)$$

This measure is similar to average contribution rates used in VCM experiments to gauge group cooperation (see Croson, 2010). Note that we apply a 30-day window to the contribution rate, meaning that we only include money paid within 30 days of the

scheduled payment. For accounting purposes, the MFI could associate any money collected, up to the point that the loan is written off, with the originally scheduled payment. For example, payment could be collected 165 days late. However, once a payment is more than 30 days overdue, the MFI becomes involved in the repayment process and applies its own enforcement mechanisms, such as taking group members to the local court. Payment within the first 30 days is a more meaningful reflection of internal group cooperation.[5]

One concern for the Group Contribution Rate is whether it meaningfully reflects group cooperation rather than financial ability to repay. Most measures of economic cooperation in a real-world setting will reflect some degree of financial ability. However, we highlight several reasons why microcredit group repayment reflects primarily cooperative willingness. First, the loan is rescheduled by the MFI if the loan officers judge the group to have genuinely encountered an inability to repay. For example, if a fire in their local market destroyed much of their inventory, the loan would be rescheduled. Second, the MFI requires that groups keep a portion of their original loan in a savings account to use in case of inability to pay. This is rarely accessed by defaulting groups, indicating unwillingness rather than inability to pay. Third, we are able to apply some financial controls affecting the ability to pay, such as loan amount per member, average monthly sales, and business equity value.

To further increase our confidence in measuring average group willingness, we constructed a second measure: Group Effort Rate. In cooperation studies, effort rate provides another key dimension of an actor's behaviour (Brown, Falk & Fehr, 2004). Here, we consider how many days overdue the group makes its first partial (or full)

[5] We verified that the results are not sensitive to the 30-day window. Applying a 180-day window or no window (including payments collected at any time) did not produce different trends in the data.

payment. Remember that the group may pay any portion of the scheduled amount at any time. The timeliness of the first partial payment reflects a group's effort in signalling their repayment intentions, rather than capturing their ability to pay the full amount. The rate is constructed as follows:

$$\text{Group Effort Rate} = \left(1 - \frac{Days\ Overdue\ First\ Part\ Pay}{30}\right) \times 100 \qquad (6.2)$$

Days overdue for the first partial payment are bounded from 0 to 30, following the Group Contribution Rate motivation discussed above. If a group makes at least some partial payment by the scheduled due date, the group effort rate equals 100. If the group's first payment is 15 days overdue, the group effort rate equals 50. In combination, the Contribution Rate (based on amount paid) and the Effort Rate (based on timeliness) offer greater insight to a group's cooperative behaviour.

6.3.2 Loan Cycle and Repayment Indices

Though groups may take multiple loans, they are all sequential. This provides a natural temporal ordering of the data points. To estimate the overall trend, we begin by including the *Overall Repayment Index*. The index continues over loan cycles, ranging from 1 to 30, with six repayment rounds for each of the five loan cycles.

Note that the underlying panel data is unbalanced. There is a significant decrease in groups proceeding to each following loan cycle. The number of groups in the first loan cycle is 1,592 and reduces steadily to 186 groups in the fifth loan cycle. This introduces a significant selection bias into the overall trend. However, we discussed this issue further in the Results section, indicating that the direction of the selection bias makes the estimation of the overall trend more conservative.

It is necessary to further distinguish two types of temporal variation in the group behaviour: across loan cycles and within loan cycles. It is expected that the ordering of

payments within a loan cycle introduces a cyclic effect, driven by factors such as a decline in available cash for repayment (Al-Azzam, Hill & Sarangi, 2012). Proceeding to the next loan cycle can be viewed as 'resetting' the contribution game. We include *Loan Cycle* to capture trends across loans and a *Within-Loan Repayment Index* to capture cyclic effects within loans. The Within-Loan Repayment Index resets to one for the first payment of each loan.

The loans also vary in their duration, i.e. how many terms are scheduled for repayment. Though all loans are scheduled with monthly repayments, their duration varies from 6 to 12 months. Typically, groups progress from shorter to longer loans. When aggregating repayment data in this analysis, we match all loans to a consistent duration: six months, the dataset minimum. For example, with a six-term loan, each payment is allocated to one of the Within-Loan Repayment Indices (one to six). With a twelve-term loan, two payments are allocated to each of the Within-Loan Repayment Indices (one to six). Matching to the same index aligns key points within loan cycles. For example, all final loan payments are associated with the Within-Loan Repayment Index of six regardless of the loan duration.[6] Analysis without duration matching, maintaining different data subsets by loan duration, verified that this approach for aggregating durations does not substantively affect repayment patterns.

All transactions have associated dates, distinct from the repayment indices. New group's regularly enter the MFI's system. To account for exogenous temporal factors, we include dummy variables for each year. We also include a seasonal dummy, denoted one for the rainy season in Sierra Leone, which is expected to have a negative effect on group repayment due to generally slower business activity.

[6] Note that when statistically analyzing the underlying panel data, we do include loan duration as a control.

We also control for autocorrelation of group repayment. We include lags for one and two prior repayments. The lags for the first two periods of any loan are set to a rate of 100, rather than the final rates of the previous loan. We test this modelling assumption by using lagged values for the final payments of previous loans and by, separately, excluding data points without two lagged values, i.e. the first two payments of each cycle. The statistical results are consistent across these different approaches.

6.3.3 Demographic, Financial, and Organizational Factors

We control for demographics by creating group-level variables from individual characteristics. See Table 6.1 for a summary of descriptive statistics. Group size in the dataset ranges from two to six members, with an average of 4.3. Experimental findings suggest that increasing group size should have a negative effect on cooperation rates (Dawes, 1980; Kollock, 1998). We also control for gender, marital status, and number of children. The proportion of female clients is 0.74, representative of the focus on women in microfinance. Most clients are married; the dataset average is 0.94. The average number of children is 3.13.

We also apply various control variables expected to affect the financial ability to repay a loan. We control for *Loan Amount per Member* and *Loan Duration*. We control for two measures of clients' financial strength: monthly sales and business equity value. Both these indicators are reported by the clients and verified by the loan officers. Note that these values are not updated monthly, but are recorded initially during the loan approval process. In addition to group averages of financial strength, we include the standard deviation of monthly sales and business equity within the group. This controls for the possibility that variation in financial strength is more important than average financial strength of the group. For example, though two groups may have the same

average monthly sales, a group in which none of the members are significantly below the average may be more able to meet monthly payments. We also include a control for business type diversity. Clients' businesses have been categorized into six types: Food, Clothing, Service, Petty Trading, Single Item Trading, and Other. Business type diversity equals the number of different business types within a group divided by the number of group members. The values are normalized with a mean of zero and a standard deviation of one.

One of the key organizational factors that may influence group cooperation rates is the involvement of the loan officer throughout the process. The dataset includes 24 different loan officers, which are incorporated as dummy variables.

Table 6.1: Descriptive Statistics

	Mean	Std Dev	Min	Max
Repayment Indices				
Overall Repayment Index	11.716	7.795	1.000	30.000
Loan Cycle	2.346	1.265	1.000	5.000
Within-Loan Repayment Index	3.643	1.702	1.000	6.000
Group Demographics				
Group Size	4.296	0.955	2.000	6.000
Proportion Female	0.735	0.299	0.000	1.000
Proportion Married	0.937	0.143	0.000	1.000
Average Children	3.134	1.047	1.000	13.333
Financial Characteristics				
Loan Amount Per Member	0.579	0.233	0.200	2.250
Loan Duration	8.166	1.690	6.000	12.000
Average Monthly Sales	1.034	0.712	0.142	9.650
Standard Deviation Monthly Sales	0.274	0.445	0.000	11.809
Average Business Equity	1.208	0.785	0.100	15.943
Standard Deviation Business Equity	0.352	0.689	0.000	25.187
Business Type Diversity	0.000	0.737	-1.257	1.838
Time Controls - Dummies				
Year 2006	0.007	0.084	0.000	1.000
Year 2006	0.124	0.330	0.000	1.000
Year 2007	0.285	0.452	0.000	1.000
Year 2008	0.224	0.417	0.000	1.000
Year 2009	0.169	0.375	0.000	1.000
Year 2010	0.187	0.390	0.000	1.000
Year 2011	0.002	0.050	0.000	1.000
Seasonal (1 = Rainy)	0.484	0.500	0.000	1.000
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Dependent Variables				
Group Contribution Rate (%)	93.926	22.140	0.000	100.000
Group Effort Rate (%)	84.871	25.720	0.000	100.000

Note: N = 31,277 for all variables. Financial Amounts in Millions of Leones (SLL)

6.3.4 Empirical Model

To apply the discussed statistical controls, we employ a hierarchical linear regression model for repeated measures (Snijders & Bosker, 2012). The model includes random intercepts for each group to account for the non-independence of their repeated measures. We fit the model to the group-level repayment data: 31,277 data points. We fit separate models for the Group Contribution Rate and Group Effort Rate. The models are of the following form:

$$Y_{ij} = \gamma_{00} + \gamma_{10}x_{1ij} + \ ... \ + \gamma_{p0}x_{pij} + \gamma_{01}z_{1j} + \ ... \ + \gamma_{0q}z_{qj} + U_{0j} + R_{ij} \quad (6.3)$$

where Y_{ij} denotes cooperation rates for payment *i* for microcredit group *j*. γ_{00} is the intercept; γ_{p0} is the coefficient for the payment-level variables, x_{pij}; γ_{0q} is the coefficient for the group-level variables, z_{qj}; U_{0j} is the residual at the group level; and R_{ij} is the residual at the payment level (*ibid*). We also fit alternative models to the data to account for the dependent variable's deviation from the normal distribution. See the Appendix for results based on binary logistic regression. The substantive results were unchanged.

6.4 Empirical Results

Table 6.2 presents a summary of the hierarchical linear regression for Group Contribution Rate. Model 1 provides a baseline control model. Model 2 introduces the Overall Repayment Index. Model 3 replaces the overall index with the Loan Cycle and Within-Loan Repayment Index variables to distinguish the overall trend from cyclic effects. Model 4, the full model, includes lag variables for contribution rate. Table 6.3 follows the same approach but uses Group Effort Rate as the dependent variable.

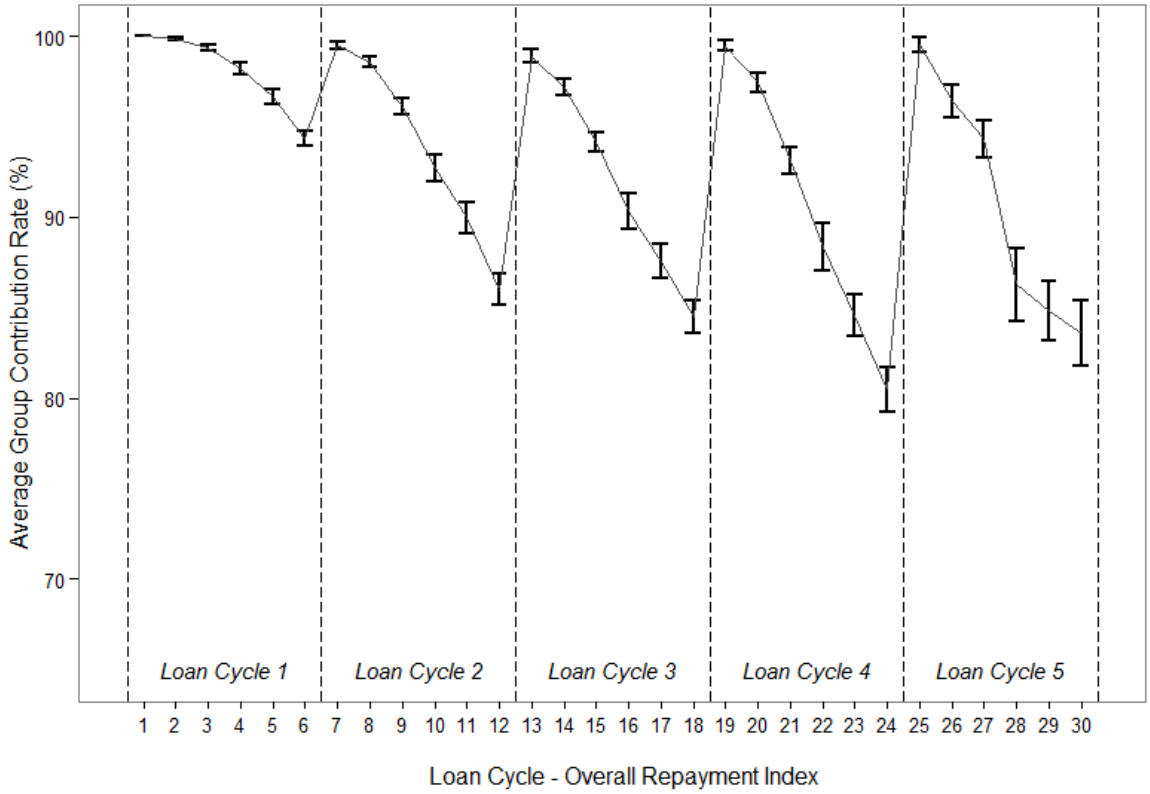
6.4.1 Group Contribution Rate

Figure 6.3 provides the aggregate trends for the Group Contribution Rate over repayment rounds. Graphically, there is a notable decline in contribution rates. Referring to Model 2, the coefficient of Overall Repayment Index is negative and significant with a p-value < 0.001. This indicates that the contribution rate declines on average over rounds, even when applying the available statistical controls. The maximum average group contribution rate is 100 percent in Round 1 and reaches the minimum in Round 24, with an average contribution rate of 88.46 percent.

Models 3 and 4 distinguish the trend across loan cycles and within-loan cycles. Referring to Figure 6.3, we see that there is a strong cyclic effect. Contribution rates are higher at the beginning of the loan cycle and then consistently decline within the loan. At the beginning of a subsequent loan cycle, the average contribution rate returns to the near 100 percent level. Referring to Model 4, the coefficient for the Within-Loan Repayment Index is negative and significant with a p-value < 0.001. This provides statistical support for the strong cyclic effect. The coefficient for Loan Cycle is negative and significant with a p-value < 0.05. This suggests that there is a general trend in declining contribution rates across loan cycles.

The lag variables in Model 4 are positive and significant, indicating that the contribution rate in a given round is positively correlated with the contribution rate in prior rounds. Introduction of the lag variables reduces the effect size attributed to the Loan Cycle and Within-Loan Repayment Index variables. We also tested for multicollinearity in these models and found that it does not have a significant effect. For example, the maximum generalized variance inflation factor in Model 4 is 3.68.

Figure 6.3: Average Group Contribution Rate Over Repayment Rounds



Note: Mean with standard error bars. Total Number of Transactions = 31,277. Tranactions by Cycle 1 = 10,869; Cycle 2 = 7,314; Cycle 3 = 6,529; Cycle 4 = 4,545; Cycle 5 = 2,020. Loan durations matched to dataset minimum: six repayments.

Table 6.2: Hierarchical Linear Regression - Group Contribution Rate in Sierra Leone, 2005-2011

	Model 1		Model 2	
	Coefficient	S.E.	Coefficient	S.E.
Repayment Indices				
Overall Repayment Index	–	–	-0.843***	(0.035)
Loan Cycle	–	–	–	–
Within-Loan Repayment Index	–	–	–	–
Contribution Rate Lag +1	–	–	–	–
Contribution Rate Lag +2	–	–	–	–
Group Demographics				
Group Size	-2.310***	(0.219)	-2.496***	(0.217)
Proportion Female	0.165	(0.882)	0.481	(0.872)
Proportion Married	0.924	(1.774)	-1.927	(1.758)
Average Children	0.638**	(0.228)	0.708**	(0.225)
Financial Characteristics				
Loan Amount	-0.055	(1.281)	11.159***	(1.352)
Loan Duration	-0.956***	(0.186)	-0.170	(0.187)
Average Monthly Sales	-4.019***	(0.514)	-4.863***	(0.510)
Standard Deviation Monthly Sales	1.306**	(0.448)	1.840***	(0.444)
Average Business Equity	0.760	(0.542)	2.436***	(0.542)
Standard Deviation Business Equity	-0.624	(0.397)	-1.750***	(0.396)
Business Type Diversity	0.149	(0.227)	0.153	(0.225)
Time Controls - Dummies				
Year 2006	-3.440*	(1.404)	0.043	(1.399)
Year 2007	-6.144***	(1.420)	0.342	(1.433)
Year 2008	-13.563***	(1.504)	-6.391***	(1.520)
Year 2009	-17.193***	(1.577)	-9.080***	(1.599)
Year 2010	-16.234***	(1.624)	-6.741***	(1.656)
Year 2011	-36.079***	(2.823)	-24.287***	(2.840)
Seasonal (1 = Rainy)	-0.538*	(0.236)	0.028	(0.235)
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Constant	113.792***	(2.932)	102.717***	(2.939)
Deviance	277391.9		276819.6	

Note: N = 31,277 repayment transactions. Random effects for 1,592 groups.

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

Table 6.2 (continued)

	Model 3		Model 4	
	Coefficient	S.E.	Coefficient	S.E.
Repayment Indices				
Overall Repayment Index	–	–	–	–
Loan Cycle	-1.998***	(0.235)	-0.271*	(0.129)
Within-Loan Repayment Index	-2.507***	(0.070)	-0.737***	(0.054)
Contribution Rate Lag +1	–	–	0.696***	(0.007)
Contribution Rate Lag +2	–	–	0.189***	(0.008)
Group Demographics				
Group Size	-1.727***	(0.215)	-0.234*	(0.115)
Proportion Female	-0.273	(0.851)	-0.202	(0.304)
Proportion Married	-1.323	(1.716)	-0.402	(0.618)
Average Children	0.616**	(0.221)	0.215*	(0.084)
Financial Characteristics				
Loan Amount	2.201	(1.374)	0.386	(0.846)
Loan Duration	-1.395***	(0.190)	-0.516***	(0.125)
Average Monthly Sales	-4.111***	(0.504)	-0.587	(0.325)
Standard Deviation Monthly Sales	1.496***	(0.439)	0.401	(0.280)
Average Business Equity	1.169*	(0.536)	-0.134	(0.326)
Standard Deviation Business Equity	-0.952*	(0.391)	-0.029	(0.239)
Business Type Diversity	0.401	(0.222)	-0.013	(0.125)
Time Controls - Dummies				
Year 2006	2.306	(1.385)	0.411	(1.052)
Year 2007	3.285*	(1.420)	0.415	(1.055)
Year 2008	-0.608	(1.515)	0.050	(1.098)
Year 2009	-1.795	(1.600)	1.480	(1.132)
Year 2010	2.763	(1.670)	1.401	(1.150)
Year 2011	-10.885***	(2.846)	-10.529***	(2.079)
Seasonal (1 = Rainy)	0.589*	(0.233)	-0.422*	(0.175)
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Constant	116.064***	(2.879)	13.326***	(1.779)
Deviance	276074.8		258177.8	

Note: N = 31,277 repayment transactions. Random effects for 1,592 groups.

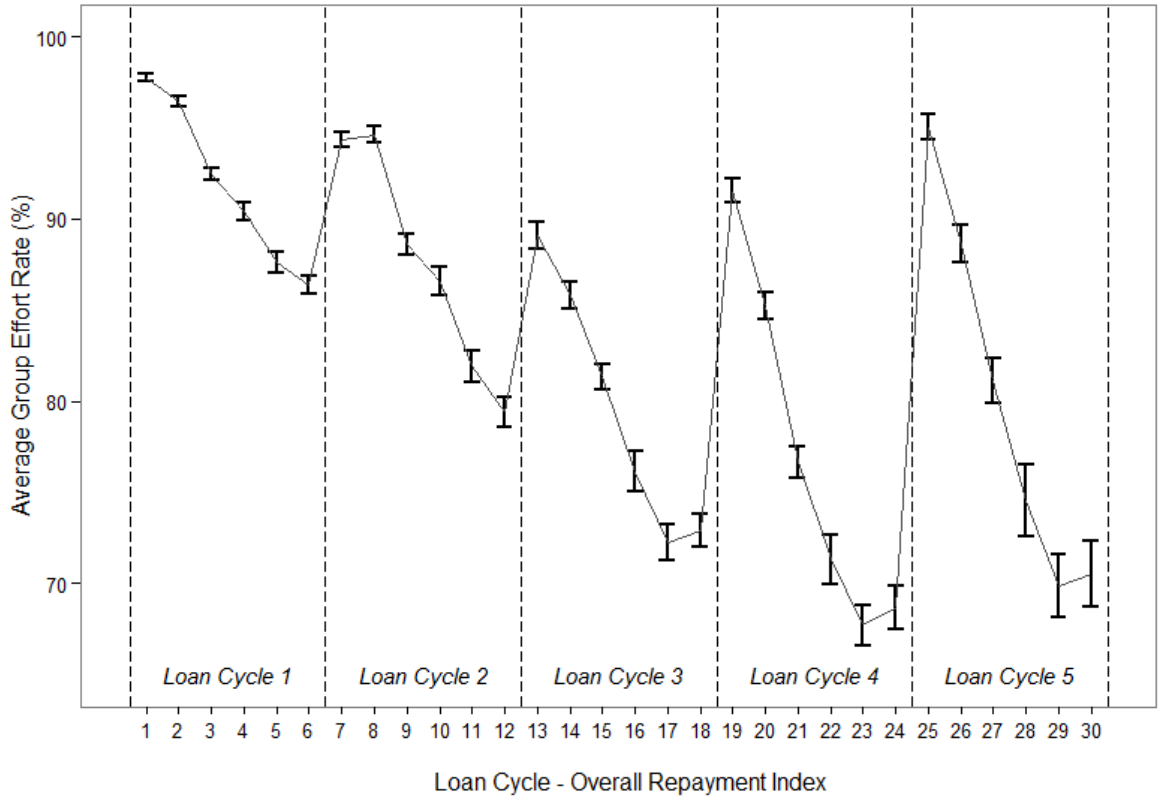
**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

6.4.2 Group Effort Rate

Figure 6.4 provides the aggregate trends for the Group Effort Rate. In comparison to the Group Contribution Rate, we see that it exhibits more variation, reaching a minimum of 67.70 percent. Also, the average effort rate does not return to the same high level at the first payment of each cycle. Referring to Model 6, the coefficient of Overall Repayment Index is negative and significant with a p-value < 0.001. This confirms that the average Group Effort Rate declines over rounds.

Again, we notice a significant cyclic effect corresponding to the loan cycle. The coefficient of Loan Cycle in Model 8 is negative and significant with a p-value < 0.001. However, the coefficient of Within-Loan Repayment Index is not significant. In contrast to the contribution rate, the aggregate effort rate does not exhibit a continual decrease within cycle. The effort rate on final payments exhibits a moderate increase. This may reflect groups showing increased effort to signal to the MFI that they are deserving of the next loan.

Figure 6.4: Average Group Effort Rate Over Repayment Rounds



Note: Mean with standard error bars. Total Number of Transactions = 31,277. Tranactions by Cycle 1 = 10,869; Cycle 2 = 7,314; Cycle 3 = 6,529; Cycle 4 = 4,545; Cycle 5 = 2,020. Loan durations matched to dataset minimum: six repayments.

Table 6.3: Hierarchical Linear Regression - Group Effort Rate in Sierra Leone, 2005-2011

	Model 5		Model 6	
	Coefficient	S.E.	Coefficient	S.E.
Repayment Indices				
Overall Repayment Index	–	–	-1.290***	(0.041)
Loan Cycle	–	–	–	–
Within-Loan Repayment Index	–	–	–	–
Effort Rate Lag +1	–	–	–	–
Effort Rate Lag +2	–	–	–	–
Group Demographics				
Group Size	-2.457***	(0.251)	-2.733***	(0.248)
Proportion Female	1.927	(1.167)	1.860	(1.162)
Proportion Married	2.101	(2.309)	-2.832	(2.303)
Average Children	0.847**	(0.288)	0.959***	(0.285)
Financial Characteristics				
Loan Amount	-7.589***	(1.422)	7.774***	(1.485)
Loan Duration	-1.678***	(0.204)	-0.573**	(0.204)
Average Monthly Sales	-3.990***	(0.569)	-5.249***	(0.562)
Standard Deviation Monthly Sales	1.724***	(0.496)	2.522***	(0.489)
Average Business Equity	2.557***	(0.607)	4.814***	(0.603)
Standard Deviation Business Equity	-1.692***	(0.444)	-3.205***	(0.440)
Business Type Diversity	0.593*	(0.258)	0.582*	(0.254)
Time Controls - Dummies				
Year 2006	-3.257*	(1.517)	2.388	(1.504)
Year 2007	-7.589***	(1.539)	3.498*	(1.556)
Year 2008	-18.990***	(1.638)	-5.841***	(1.668)
Year 2009	-21.354***	(1.729)	-5.889***	(1.774)
Year 2010	-25.295***	(1.792)	-6.830***	(1.864)
Year 2011	-41.937***	(3.078)	-19.536***	(3.115)
Seasonal (1 = Rainy)	-1.598***	(0.256)	-0.440	(0.255)
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Constant	118.048***	(3.489)	101.427***	(3.496)
Deviance	282778.2		281816.8	

Note: N = 31,277 repayment transactions. Random effects for 1,592 groups.

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

Table 6.3 (continued)

	Model 7		Model 8	
	Coefficient	S.E.	Coefficient	S.E.
Repayment Indices				
Overall Repayment Index	–	–	–	–
Loan Cycle	-3.646***	(0.276)	-0.569***	(0.157)
Within-Loan Repayment Index	-3.289***	(0.076)	0.004	(0.062)
Effort Rate Lag +1	–	–	0.626***	(0.006)
Effort Rate Lag +2	–	–	0.194***	(0.007)
Group Demographics				
Group Size	-1.680***	(0.246)	-0.126	(0.142)
Proportion Female	0.934	(1.137)	0.420	(0.407)
Proportion Married	-1.800	(2.253)	-0.804	(0.829)
Average Children	0.826**	(0.280)	0.223*	(0.112)
Financial Characteristics				
Loan Amount	-3.745*	(1.507)	-1.460	(1.020)
Loan Duration	-2.152***	(0.207)	-0.793***	(0.147)
Average Monthly Sales	-4.248***	(0.554)	-0.439	(0.383)
Standard Deviation Monthly Sales	2.045***	(0.482)	0.236	(0.331)
Average Business Equity	3.150***	(0.596)	0.324	(0.390)
Standard Deviation Business Equity	-2.165***	(0.434)	-0.298	(0.285)
Business Type Diversity	0.913***	(0.250)	0.309*	(0.153)
Time Controls - Dummies				
Year 2006	4.971***	(1.483)	-0.742	(1.175)
Year 2007	6.661***	(1.536)	-1.478	(1.184)
Year 2008	0.734	(1.655)	-2.552*	(1.239)
Year 2009	2.472	(1.766)	-0.203	(1.283)
Year 2010	4.215*	(1.867)	-0.674	(1.309)
Year 2011	-3.813	(3.107)	-3.859	(2.336)
Seasonal (1 = Rainy)	0.209	(0.252)	-0.550**	(0.196)
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Constant	119.647***	(3.418)	19.145***	(2.057)
Deviance	280845.8		265049.1	

Note: N = 31,277 repayment transactions. Random effects for 1,592 groups.

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

6.4.3 Selective Retention and Stability of Cooperation Rates

The empirical data suggests a general decline in contribution and effort rates, both within and across loan cycles. It is interesting to note that this decline occurs even though there is a selection bias allowing only the better performing groups to proceed. Figure 6.5 displays the sample size by loan cycle. Larger samples in earlier loan cycles are a result of selective retention by the MFI, as well as the fact that newer groups have not had the opportunity to progress to higher loan cycles yet.

Figure 6.5: Number of Groups by Loan Cycle

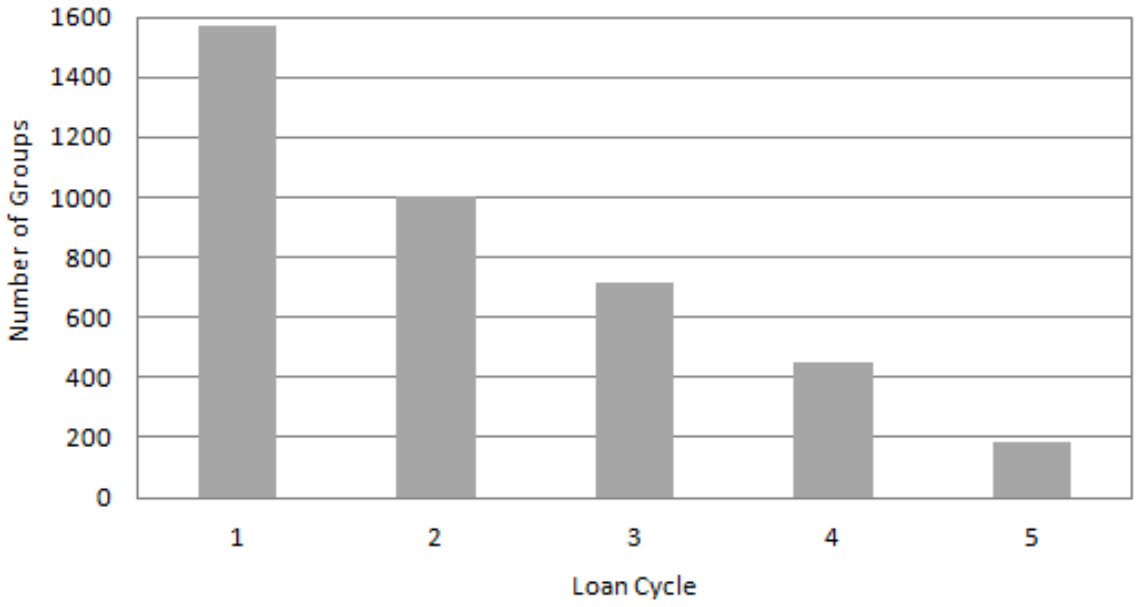
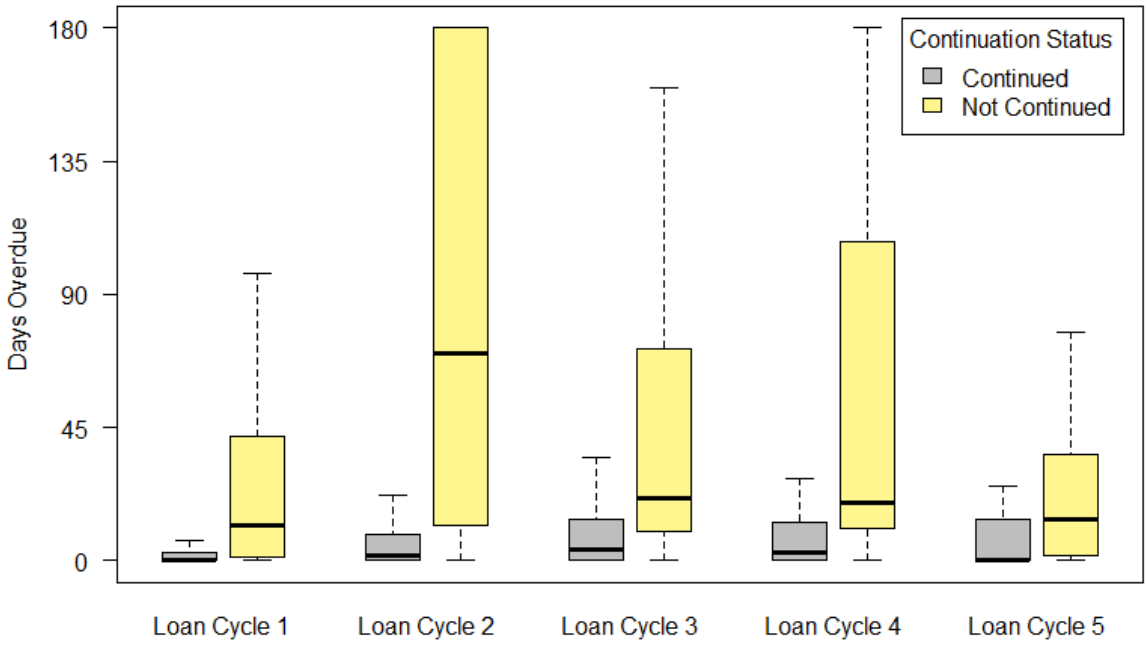


Figure 6.6 focuses on the effect of selective retention by the MFI. The data is divided into groups that do proceed to another loan cycle and those that do not.[7] The box plots show that groups that do not proceed performed significantly worse on average. As expected, poorly performing groups are not invited by the MFI to proceed to the next

[7] Not proceeding may result from the MFI not allowing the group to continue, as well as from the group's own preference for not taking another loan. We do not include groups that finished their loan within the last year, as it is uncertain whether to classify them as continuing or non-continuing.

cycle. This is helpful for interpreting the overall trend in declining cooperation rates. This selective retention of better performing groups likely causes the decline in cooperation to be underestimated if at all.

Figure 6.6: Performance Subsets by Continuation Status



Note: N = 3,327. Box and whisker plot for days overdue for each group loan. 'Continued' proceeded to next cycle. 'Not Continued' did not proceed to next cycle.

Finally, we also test for the stability of cooperation rates over repayment rounds. Visual inspection of residuals suggests that variance across groups increases with repayment rounds. However, with changing sample sizes it is difficult to assess this visually. We formally test for a change in variance by using the Breusch-Pagan test for heteroskedasticity. The null hypothesis of homoskedasticity for Group Contribution Rate across loan cycles was rejected with a chi-squared statistic of 495.18. The null hypothesis was also rejected for Group Effort Rate across cycles with a chi-squared statistic of 618.92. Both the statistics are significant with a p-value < 0.001. The data

does not support the idea of groups having reached stable cooperation rates. Variation in cooperation rates increases rather than decreases over rounds.

6.5 Discussion

Microfinance provides a well-structured, real-world setting for analyzing economic cooperation in small groups. Our review of the findings from cooperative games suggested that the context of group lending is conducive to several structural, strategic, and motivational mechanisms promoting the positive evolution of group cooperation. Structurally, groups are small, consist of self-selected members, and are open to the removal of defecting members. Strategically, repeated interactions provide the possibility for reciprocity, public knowledge of payments supports indirect reciprocity, and avenues for social punishment are conducive to strong reciprocity. Motivationally, close proximity and regular communication provide opportunities for group solidarity and moral suasion.

However, the empirical data from Sierra Leone demonstrates strong trends in the decline of cooperation in microcredit groups.[8] Contribution and effort rates start out high, but they consistently decline, both within and across loan cycles. Variance across groups also increases over rounds. This suggests that within five loan cycles aggregate group behaviour has not reached stable cooperation rates. These trends in the decline of cooperation are particularly striking considering the selective retention of well-performing groups by the MFI.

[8] Similar microcredit repayment patterns have been noted in other cultural contexts. However, they have not been analyzed as a cooperative dilemma. See for example, repayment trends in Burkina Faso (Paxton, Graham & Thraen, 2000) and Jordan (Al-Azzam, Hill & Sarangi, 2012).

These empirical results should also be interpreted in light of findings from experiments involving the VCM game. In the basic VCM game, average cooperation rates decline over rounds (Croson, 2010), similar to the aggregate trend found in the microfinance data. This can be contrasted with variants of the VCM game that introduce additional mechanisms expected to promote cooperation, such as the option to punish (Fehr & Gintis, 2007) and the ability to communicate (Ostrom et al, 1994). In such studies, cooperation rates typically increase over rounds. Surprisingly, the trends produced by these augmented versions of the VCM game differ strongly from those found in the empirical microfinance data. Furthermore, most studies involving VCM games to examine the stability of cooperation find that contribution rates converge to a stable equilibrium (Chen & Plott, 1996; Gunnthorsdottir et al, 2007). However, in the microfinance data, after more than 30 group payments over multiple loan cycles, we find no evidence that a stable cooperation rate has been reached at an aggregate level.

What mechanisms are driving the decline in economic cooperation? The negative trend suggests that the structural, strategic, and motivational mechanisms as described are not dominating the aggregate group behaviour. Though they may have some influence, they are not likely to produce a strong decline in cooperation. We now consider other types of cooperative mechanisms that provide a stronger fit to the empirical results.

In the Theory section of this paper, we highlighted the role of framing in economic games (Croson, 2010). One key distinction in framing is the difference between 'giving' and 'taking' games. In real-world settings there are myriad other framing effects that may have a strong influence on group behaviour. Tversky and Kahneman's (1981) research documented several types of framing that consistently

affect economic decisions. In the context of microfinance, we draw attention to one particularly poignant frame: the perceived source of the funds.

The key distinction in source of funds is whether it is viewed as internal or external to the community. If it is viewed as internal to the community, borrowers would view defaulting as taking money from other members whom they knew personally. If it is viewed as external to the community, a defaulting client is applying a negative externality to an unknown entity. Drawing on interviews with clients in Sierra Leone, we found that they often used phrases such as "I must pay back this government money." While the source of funds in reality is not from the government, actually a non-governmental organization (NGO), the borrower's description emphasizes her perception that the source of funds is external.

Evidence for the importance of this framing is found in the behaviour of Rotating Savings and Credit Association (RoSCA) members. RoSCAs provide a similar function as microfinance institutions, but are less formalized and more community-based. RoSCA members contribute to a group pot at regular meetings. The pot is distributed to each member in turn. Depending on one's order in the rotation, RoSCAs play either the role of a savings or credit product. See Besley, Coate, and Loury (1993) for more detail on RoSCA structure. In Sierra Leone, RoSCAs are referred to as Osusus. They typically involve between 10 to 50 members and are organized by a local community member in her spare time, i.e. it is not her primary occupation. In Sierra Leone, individuals often simultaneously belong to an Osusu and a microcredit group. The notable distinction is that Osusus do not typically suffer from a decline in cooperation rates. Osusu leaders in Sierra Leone indicated that contribution rates are stable and are occasionally affected by a rare defector who typically flees the community. Prior research on RoSCAs has also emphasized how the internal framing of direct impact on fellow community members

helps to maintain the high cooperation rates (Geertz, 1962; Ardener, 1964). Thus, a key source of declining cooperation in MFI repayment may stem from its framing as an external funding source.

Learning is another cooperative mechanism that may have long-term effects on microfinance cooperation. A priori, learning in VCM games does not predict a decline or increase in cooperation rates. Learning the game structure may lead a participant to prefer defection over cooperation or vice versa (Rapoport et al, 2008). Likewise, in the context of microfinance, a borrower's understanding of the loan and organizational processes may have a positive or negative effect. Qualitative research with borrowers as well as MFI staff indicate that learning has a negative effect on repayment. Staff note that borrowers get to know their loan officers and figure out how much they can allow their performance to deviate and still be held in acceptable regard by the organization.

This view of actor learning is also supported by the cooperative games involving threshold effects. The standard VCM game has also been adapted to include a provision point (Bagnoli & Lipman, 1989). At the beginning of the game it is announced that if a certain threshold in the group account is reached the public good will be produced for all members. Otherwise, no public good is produced. When a threshold is introduced, collective behaviour typically fluctuates narrowly around the threshold (Croson, 2010). Participants learn to coordinate their behaviour so that they individually do not need to contribute anything more to the group than is necessary to reach the threshold. In microfinance, it is likely that learning and awareness of the organizational thresholds help explain the decline in contribution and effort rates.

The final notable mechanism involves the ability and willingness to punish. Significant laboratory evidence has noted that the opportunity to punish promotes cooperation rates (Fehr & Gächter, 2002). Theoretically, group lending provides a

context for punishing defectors using social sanctions, such as expulsion from the group or public embarrassment. However, research has shown that strong social ties may reduce borrower willingness to enforce the loan on group members (Sabin & Reed-Tsochas, 2014). If social relationships outweigh the economic incentives, enforcement and repayment decline. It is difficult to detect punishment, particularly a willingness to punish, based on aggregate group lending behaviour. However, other microfinance research has argued that microcredit groups are less likely to sanction members over time (Godquin, 2004; Postelnicu, Hermes & Szafarz, 2013). Further research documenting the range of punishment forms and their usage rates in microfinance is needed to this confirm this.

This research has suggested that microcredit groups are a structurally-conducive environment for economic cooperation. However, the empirical data indicates that group cooperation starts high, but evolves along a negative path. We have suggested that even with a supportive structure, certain psychological and social mechanisms may still dominate and cause the collective behaviour to decline. We have posited that framing, learning, and unwillingness to punish can play key roles. Further structured analysis of group behaviour in the microfinance context would provide valuable real-world insight as to how economic cooperation evolves over years of repeated interaction.

6.6 Appendix

Table 6.4: Binary Logistic Regression - Group Repayment in Sierra Leone, 2005-2011

	Model A1		Model A2	
	Coefficient	S.E.	Coefficient	S.E.
Repayment Indices				
Overall Repayment Index	–	–	-0.099***	(0.004)
Loan Cycle	–	–	–	–
Within-Loan Repayment Index	–	–	–	–
Contribution Rate Lag +1	–	–	–	–
Contribution Rate Lag +2	–	–	–	–
Group Demographics				
Group Size	-0.238***	(0.025)	-0.266***	(0.025)
Proportion Female	-0.341***	(0.064)	-0.151*	(0.066)
Proportion Married	-0.119	(0.137)	-0.324*	(0.139)
Average Children	0.063***	(0.018)	0.072***	(0.019)
Financial Characteristics				
Loan Amount	-0.150	(0.165)	0.824***	(0.177)
Loan Duration	-0.100***	(0.024)	0.018	(0.025)
Average Monthly Sales	-0.172**	(0.062)	-0.313***	(0.065)
Standard Deviation Monthly Sales	0.131*	(0.057)	0.203***	(0.056)
Average Business Equity	-0.117	(0.063)	0.164*	(0.068)
Standard Deviation Business Equity	0.088	(0.049)	-0.093	(0.052)
Business Type Diversity	-0.089***	(0.027)	-0.088**	(0.027)
Time Controls				
Seasonal Dummy (1 = Rainy)	0.006	(0.037)	0.027	(0.038)
Year (6 dummies included but now shown)				
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Constant	17.440	(94.666)	16.216	(94.880)
Deviance	21155		20610	

Note: N = 31,277 repayment transactions.

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

Table 6.4 (continued)

	Model A3		Model A4	
	Coefficient	S.E.	Coefficient	S.E.
Repayment Indices				
Overall Repayment Index	–	–	–	–
Loan Cycle	-0.299***	(0.028)	-0.268***	(0.031)
Within-Loan Repayment Index	-0.418***	(0.013)	-0.289***	(0.014)
Contribution Rate Lag +1	–	–	0.040***	(0.001)
Contribution Rate Lag +2	–	–	0.016***	(0.002)
Group Demographics				
Group Size	-0.173***	(0.026)	-0.107***	(0.029)
Proportion Female	-0.285***	(0.067)	-0.406***	(0.075)
Proportion Married	-0.291*	(0.141)	-0.334*	(0.158)
Average Children	0.070***	(0.019)	0.056**	(0.021)
Financial Characteristics				
Loan Amount	0.121	(0.176)	-0.109	(0.196)
Loan Duration	-0.144***	(0.026)	-0.078**	(0.029)
Average Monthly Sales	-0.250***	(0.065)	-0.219**	(0.072)
Standard Deviation Monthly Sales	0.188**	(0.058)	0.178**	(0.067)
Average Business Equity	0.027	(0.069)	0.029	(0.076)
Standard Deviation Business Equity	-0.005	(0.053)	0.021	(0.060)
Business Type Diversity	-0.052	(0.028)	-0.057	(0.031)
Time Controls				
Seasonal Dummy (1 = Rainy)	0.092*	(0.038)	0.000	(0.043)
Year (6 dummies included but now shown)				
Organizational Controls				
Loan Officer (24 dummies included but now shown)				
Constant	17.905	(94.123)	11.399	(95.549)
Deviance	19789		16915	

Note: N = 31,277 repayment transactions.

**p<.05 **p<.01 ***p<.001 (two-tailed tests)*

Theoretically, a group may contribute any amount of their monthly payment from 0-100 percent. However, empirically, groups are most likely to make the payment in full or miss it completely. Here we consider the effect of this issue with a different

modelling approach. We dichotomize the contribution rates into full payment (coded 1) and less than full payment (coded 0). We apply a binary logistic regression model and find the substantive trends in the data are the same as in the principal analysis.

7 Discussion

In this section, the three papers are viewed more holistically. The intent is not simply to reiterate the findings and contributions previously summarized in the introduction and detailed in each paper. Rather, I discuss the broader academic and methodological contributions, potential implications for microfinance policy, and suggestions for future research.

7.1 Integrating Social and Economic Theory

A consistent question has run throughout these papers: "Microfinance is based on the unique model of group lending; how do social and economic mechanisms interact to systematically affect group behaviour?" The intent has been to give a balanced analysis of both the social and economic mechanisms. Most prior studies of microfinance have tended to focus on economic factors, with a very limited treatment of social factors. The aim of these papers has been to provide a more in-depth and systematic analysis of the social mechanisms, but not at the expense of discounting financial motivations. Specifically, in this dissertation, I make no assumption of pro-social behaviour. It is assumed that client motivations are heterogeneous and may range from altruism to personal financial gain (see e.g. Gintis et al, 2005). But despite these different potential motivations, does social structure still consistently influence microfinance behaviour? The studies in this dissertation suggest that the answer to that question is yes.

In the paper on group formation, I found that leaders have a strong preference for socially and spatially proximate members and a mild preference for matching business types. The motivation for these preferences appears to be increased personal trust between members, which reduces the risk of them strategically defaulting. In the paper on the structure of social collateral, we found that structural embeddedness produces

both benefits and challenges to group repayment. However, there were consistent net effects indicating that highly embedded groups and fragmented groups perform worse. In the paper on the evolution of cooperation, we found that economic cooperation in groups is generally high; however, it consistently declines over time. The decline likely results from social and psychological factors such as willingness to punish and learning. The decline occurs despite including financial controls for loan amount and duration and the fact that only the better performing groups proceed to the subsequent loan cycles.

Across these studies, social factors have been found to produce significant effects on microfinance client behaviour. What are the size of these effects in the context of microfinance? How much variation in client behaviour can be explained by social factors? Generally, the size of the effects are substantial. For example, a spatially fragmented group repays their loan on average 29 days later than an unfragmented group. This is a notable difference that has financial implications for lending institutions. In terms of group formation, the odds of being invited to join a group earlier rather than later decrease by a substantial factor, less than 0.01 for an additional kilometre between the leader and borrower.

In general, social and spatial factors were found to be stronger than the financial and control variables. This is not to say that financial factors are not relevant to explaining microfinance behaviour. Most clients run extremely constrained businesses, often petty trading with average monthly sales of 820,000 SLL (approximately $190 USD at the time of data collection). At this level, the variation in monthly sales across clients may not be substantial. However, even for these financially constrained borrowers, there is substantial variation in social structure across microcredit groups. The social relationships range from those borrowers introduced just for the purpose of the loan to those who have lived next door to each other their whole lives. Thus, in the

context of microfinance, much of the variation in behaviour results more from variation in social factors rather than from variation in economic factors.

Despite the strong effects of several social factors, there is still a large portion of unexplained variance in microcredit group behaviour. For example, the statistical models in the papers produced R^2 or pseudo-R^2 measures ranging from 0.19 to 0.48. This low to moderate measure of explained variation is consistent with most other studies on microfinance (see e.g. Wydick 1999; Karlan 2007). Historically, lending institutions have noted that it is incredibly difficult to accurately predict microfinance client repayment. That fundamental challenge has motivated much of the current microfinance model in practice, such as drawing on local information through group lending. When interpreting the results of these studies, it is then useful to keep in mind that social factors may be some of the strongest indicators of microfinance client behaviour, but there is still a substantial component of behavioural variation that cannot be predicted with these models.

7.2 Mixed Empirical Methods and Data Resolution

A consistent feature of this dissertation has been the use of rich empirical data from Sierra Leone. The integration of different types of data ranging from interviews, to GPS, to loan portfolio statistics, is a notable contribution to economic sociology methodology. The use of mixed methods is a growing area for social science research, offering novel insights to problems not well suited to strictly qualitative or quantitative research (Poteete et al, 2010; Creswell & Clark, 2011). Table 7.1 provides a summary of the different data types and analytical methods used in the three papers of this dissertation. The motivation for applying such diverse techniques has been that group financial behaviour is a complex phenomenon. Any research method will have its own

idiosyncratic limitations and biases. One of the best solutions to overcoming these limitations is the use of mixed methods. The weakness of one method may be the strength of another (King et al, 1994). By integrating these different approaches, I hope to have produced a more complete and robust depiction of group financial behaviour.

Though the questions in this dissertation have involved a similar set of topics, the papers have been targeted at different audiences. Group financial behaviour is an inherently interdisciplinary topic. Reflecting this, the papers were prepared for a sociology journal, economic development journal, and interdisciplinary science journal.

Table 7.1: Summary of Methods by Paper

Paper	**Primary Theory**	**Target Audience**	**Empirical Data**	**Primary Analytic Method**
"The Structure of Social Collateral"	Economic sociology	Sociology	Interviews (n=64); Survey (n=410); GPS loan data (n =1,884)	Qualitative coding; Dyadic regressions; Multilevel regressions
"Joint Liability Group Formation"	Group formation and risk sharing	Development economics	Selection order survey (n=140)	Rank-ordered logistic regressions
"The Evolution of Economic Cooperation"	Behavioural experiments on cooperation	Inter-disciplinary science	Loan data (n=47,931 transactions)	Multilevel panel regressions

Another consistent feature of this dissertation has been the use of comparatively fine-grained empirical data. See Table 7.2 for a summary of prior empirical findings on group lending. For example, prior studies have used binary group-level measures of social ties. Anthony (2005) uses a binary designation of previous ties if at least two members knew each other previously. Wydick (1999) uses a binary designation of previous ties if all the members knew each other previously. In contrast, this study considers dyadic-level connections. For example, in the analysis of social collateral, affiliation survey data is used to define a social connection between each group member.

In the case of group formation, the connection between the leader and each group member is recorded as a pre-existing tie or a referral.

The data is also higher resolution in terms of group performance. Many microcredit studies use coarse-grained measures of loan default (Hermes & Lensink, 2007). This study draws on more detailed information at the monthly payment level. The days early or late for each payment and the amounts of partial payments provide more detailed accounts of group behaviour.

Table 7.2: Summary of Prior Empirical Findings on Group Repayment

Study	**Sample**	**Negative Effect on Repayment**	**Neutral**	**Positive Effect on Repayment**
Feigenberg, Field & Pande (2013)	100 groups in India			▪ Meeting frequency
Azzam, Hill & Sarang (2012)	160 groups in Jordan	▪ Cooperation (1-6 survey based)	▪ Relatives (fraction of group) ▪ Screening (binary, if group declined applicants)	▪ Spatial proximity (binary < 1 km) ▪ Willingness to pressure members (1-4 survey based) ▪ Social cohesion (1-5 survey based) ▪ Phone access (fraction of group)
Karlan (2007)	42 groups in Peru (616 individuals)		▪ Spatial proximity (average distance in minutes to members)	▪ Spatial proximity (fraction of group < 10 minute walk) ▪ Cultural similarity (1-8 Western-Indigenous index)
Ahlin & Townsend (2007)	262 groups in Thailand	▪ Relatives (fraction of group) ▪ Cooperation (survey of sharing and joint decisions)	▪ Homogenous business types	▪ Spatial proximity (fraction living in same village) ▪ Correlated borrower returns
Hermes, Lensink & Mehrteab (2005)	102 groups in Eritrea		▪ Social ties of members (binary knew other members previously) ▪ Spatial proximity of members (metres)	▪ Social ties of leader (binary knew members previously) ▪ Spatial proximity of leader (metres) ▪ Frequency of interaction (binary regular visits)
Anthony (2005)	106 groups in the United States		▪ Group identity (1-10 survey based) ▪ Sanctions (0-2 survey based) ▪ Previous ties (binary at the group level)	▪ Reciprocity (0-2 survey based)

Table 7.2 (Continued)

Study	Sample	Negative Effect on Repayment	Neutral	Positive Effect on Repayment
Paxton, Graham & Thraen (2000)	140 groups in Burkina Faso	▪Social homogeneity (1-9 index of criteria such as gender, age)		▪Leadership training ▪Willingness to pressure members (1-10 survey based)
Wydick (1999)	137 groups in Guatemala		▪Gender homogeneity ▪Business homogeneity ▪All friends prior ▪Shared social activity ▪Willingness to pressure ▪Willingness to sanction ▪Viewed as moral obligation (all binary at the group level; survey based)	▪Spatial proximity (average kilometres between businesses) ▪Knowledge of member sales (binary survey based)
Zeller (1998)	146 groups in Madagascar		▪Group initiated by member ▪Land wealth	▪Social cohesion (number of common bonds: village, family, ethnicity, religion, gender) ▪Formal rules of conduct
Sharma & Zeller (1997)	128 groups in Bangladesh	▪Relatives (fraction of group)		▪Gender (fraction female) ▪Number of dependents ▪Group formed through self-selection (binary)
Wenner (1995)	25 groups in Costa Rica	▪Village infrastructure (0-5 index)		▪Formal rules of conduct

The high resolution data in this study has provided two main benefits. First, the more obvious benefit is that it provides greater clarity of the empirical relationship and the underlying mechanisms. Second, the less obvious benefit is that one may be able to resolve previously conflicting findings. For example, Table 7.2 summarizes factors found to affect group repayment empirically. Several studies have attempted to measure social cohesion as a social homogeneity index (Zeller, 1998; Paxton et al, 2000; Karlan 2007). Other studies have considered the fraction of relatives in a group (Sharma & Zeller, 1997; Ahlin & Townsend 2007). Yet others have recorded whether the group members knew each other prior to the loan (Wydick, 1999; Hermes et al, 2005). Despite researchers motivated by a similar question of how group social cohesion affects repayment, the result is a mix of findings ranging from positive, to neutral, to negative.

The challenge arises from a broad theoretical concept and coarse-grained empirical measures capturing different mechanisms. Fortunately, higher resolution empirical data supports refining these theoretical concepts and looking at a particular factor in more depth. For example, prior group lending studies have looked at the effect of spatial proximity. Karlan (2007) used the fraction of the group within a ten minute walk and Azzam et al (2012) used a binary measure if group members were within one kilometre of each other. With such coarse-grained measures, researchers are limited in understanding the effect of distance on repayment. They found only a categorical or linear effect. In contrast, we have been able to explore the possibility of a non-monotonic relationship by using continuous, high-resolution spatial data. The findings suggest that moderate distance groups perform better than those at the spatial extremes. I believe this reflects a basic challenge in measuring concepts related to spatial and social embeddedness. I suspect by refining theoretical concepts and gathering more fine-grained empirical data, many of the prior findings would be reconciled.

7.3 Implications for Microfinance Policy

Implications from the three papers are at times related and overlapping. Therefore, rather than considering the implications drawn from each paper, I categorize the implications by topics relevant to microfinance policy: (1) the group formation process, (2) contract design, and (3) loan management.

Before proceeding with the policy implications, three caveats are necessary. First, the research designs employed in this dissertation are not ideally suited for proceeding directly to policy implications. Though a variable in a multiple regression may have a consistent relationship with the outcome measure, manipulating the variable in practice may have unintended consequences on overall outcome. Other research designs, for example randomized controlled trials, are better suited to gauging the effect of proposed interventions. Second, this research focuses on economic effects. However, microfinance institutions are typically motivated by dual objectives: financial sustainability and social impact. Therefore, implications from this research may not reflect all the interests of a microfinance institution. Third, there is a question of generalizability. All the empirical data drawn on in this dissertation are from Sierra Leone. Additional studies from other cultures are necessary to gauge the generalizability. Therefore, the policy implications discussed here are not suggestions for direct implementation but, rather, potential policy ideas worthy of further research.

7.3.1 Group Formation Process

We have found that groups with different social and spatial structures are associated with different levels of repayment. The natural question arises as to whether the group formation process could be directed so that more beneficial groups are produced, in terms of their composition or structure. Though groups are typically self-

selected, the organization still has some influence over the process.[1] One policy implication is a shift in loan officer heuristics. Typically, loan officers are advised to promote the selection of group members with whom the clients are highly embedded. However, this research has suggested that such a heuristic may not be beneficial, both for the lending institution, as a result of increased default rates, and for the clients, as a result of excessive social pressure. One approach would be to simply instruct loan officers to not focus on creating extremely embedded groups. In particular, loan officers should avoid groups in which it would seem difficult for members to enforce the loan on each other. Direct kin is an obvious case, but this could also be expanded at the discretion of the loan officer. In presenting this research at a recent microfinance conference, I encountered an MFI which had implemented a more quantifiable criteria: group members should not live within a ten minute walk of each other. The staff of this MFI in Jordan indicated that their heuristic was proving useful in group formation. If employing such a heuristic, one should be wary of excessive manipulation of the group formation process. Research has shown that group members selected by the organization typically perform worse than groups created through self-selection (Sharma & Zeller, 1997). According to the executive director of the microfinance institution in this study, group members are less likely to contribute for a defaulting member if he or she was assigned to the group, rather than someone they selected themselves. Therefore, any loan officer heuristic should still maintain a client's choice in the process.

[1] The research in this dissertation has viewed group performance from the perspective of the MFI. Full and timely loan repayment is consistently a benefit to the MFI, but is not necessarily a benefit to the client. One may assume that most of the time loan repayment is a positive sign for the client as well, but this will not always be the case. For example, defaulting on a loan may allow the borrower to seek medical treatment.

7.3.2 Contract Design

The second policy topic concerns whether changes to the structure of the joint liability contract may be beneficial. Researchers have noted that joint liability contracts can have both positive and negative effects on individual repayment within the group (Besley & Coate, 1995). The positive result, from the perspective of the lending institution, occurs when group members contribute for a member who is unable to pay. The negative result occurs when a group collectively defaults when some of the members would have repaid individually had they not been burdened with the defaulting members. The research in this dissertation has also pointed out how joint liability can produce both positive and negative effects in terms of borrower welfare.

Is it possible to design a contract that harnesses more of the potential benefits and fewer of the potential drawbacks of group lending? One suggestion is the continued use of group repayment meetings, but with the formal removal of joint liability. For example, no group members would formally be expected to pay for another member, but the group would still meet in a public place and members would naturally be made aware of who is repaying and who is having difficulties. Without the liability contract, would the primary basis for group lending be undermined? There is evidence from Bangladesh that this may be a beneficial compromise. Such an approach has been implemented by the Grameen Bank with the organization successfully transitioning from joint liability to informal group meetings (Yunus, 2003). The intuition is that this approach maintains some of the social benefits from group lending, such as solidarity and willingness to support clients in need, while reducing drawbacks associated with joint liability, such as collective default or excessive social pressure.

7.3.3 Loan Management

If group lending is used, be it via formalized joint liability or informal group meetings, can measures be taken after the loan has been disbursed to ethically promote group repayment? I suggest two possibilities here: frequency of group meetings and transitioning to individual loans. The first implication for managing such loans is to increase the frequency of group meetings. Recent research by Feigenberg, Field & Pande (2013) found that by increasing meeting frequency to bi-weekly interaction, rather than monthly interaction, social capital and repayment rates significantly improved. However, this research suggests that the value of increased group meetings may depend on the group's structure. The findings from the paper on social collateral suggest that highly embedded groups would not benefit from more meetings. They already see each other daily and more formal meetings are not likely to increase their communication or solidarity. However, some group structures, such as those that are spatially fragmented, may benefit from more frequent meetings. Fragmented groups seem to struggle with communication and solidarity across the subgroups. Thus, a lending institution could qualitatively assess a group's social structure and assign an appropriate meeting-repayment schedule.

The second implication stems from the third paper in which we found that group cooperation consistently declines over time. Research suggests that most clients would prefer to have an individual loan over a joint-liability loan (Ditcher & Harper, 2007). Some microfinance institutions are more proactive in attempting to transition clients from group to individual loans (e.g. Yunus, 2003). Though the costs and benefits of group lending are complex, the finding that group cooperation consistently declines is another reason for proactively proceeding to individual lending. Transitioning a borrower who has progressed through a certain number of group loan cycles may offer

the MFI the screening and enforcement benefits of group lending and also maintain a stronger repayment rate over subsequent loan cycles. Further studies exploring the effects of transitioning to individual loans, such as Giné and Karlan's (2014) randomized controlled trials in the Philippines, are needed.

7.4 Limitations and Future Research

In this final section of the dissertation, I discuss several limitations of the research and make suggestions for future studies. The first issue relates to the measurement of social structure. Social structure is inherently a complex concept and can refer to an infinite number of relationship types existing between actors. In this dissertation, I have considered social structure in terms of: social affiliations based on community organizations, frequency of interaction and likelihood of personal connections based on physical space, and personal social ties predating group formation. However, this captures only a small portion of the potentially relevant information regarding social structure and group lending. Further research would benefit from explicit mapping of social ties between borrowers, and in particular capturing the strength of ties. This research has suggested that a willingness or unwillingness to enforce the loan is a key factor in group behaviour. One may suspect that tie strength is inversely related to willingness to enforce. Ability to distinguish social ties which would likely affect the willingness to enforce would be a substantial contribution. Furthermore, this research has primarily focused on the role of social ties within the microcredit group. However, it is likely that social ties external to the group would also have a significant impact on the group's behaviour. The primary challenge here is that once a researcher expands beyond the population of microfinance clients, identifying and gathering data on non-clients is substantially more time consuming and introduces more subjectivity in terms of defining the population set. However, this could shed light on unobserved social dynamics in the current research.

The second issue regards the generalizability of this research. Theoretically, I have drawn on research related to microfinance around the world, as well as more abstract theory on economic sociology and cooperation. However, all the empirical data

used in this dissertation was drawn from Sierra Leone. I did take measures to ensure that the practices employed by this microfinance institution were common to other institutions in Sierra Leone. It is my expectation that the results produced in this dissertation are theoretically generalizable to other contexts. For example, it is likely that group leaders prefer spatially proximate members during the group formation process. However, the exact nature of the relationship would likely need to be calibrated for different cultural contexts. The effect of one kilometre will have different social implications, given a region's spatial density and cultural norms. Likewise, legal structures will vary by country and may influence the client's concern for personal trust in entering a financial contract. Calibrating such relationships requires culturally specific data. The generalizability of this research, as well as its internal validity, could also be enhanced with additional research designs. The analysis in this thesis has focused on observational data. Alternative designs, such as randomized controlled trials in the field, may provide further insight regarding causal mechanisms and clarify which microfinance institutions would be likely to find similar behaviour.

The third issue concerns the measures of performance used in this dissertation. Microfinance institutions are typically motivated by financial sustainability, as well as social impact. This dissertation has focused on loan repayment as the primary dependent variable. Most research on microfinance has considered similar performance measures. The primary motivation for focusing on economic performance is that microfinance institutions already track loan repayment. There are also well-established measures for categorizing economic performance of loan repayment. For example, loan delinquency is often categorized at 30, 90, and 180 days overdue. However, there would be significant benefits for conducting research on social impact from the client's perspective. Microfinance institutions and researchers have not fully agreed on the

appropriate measures of social impact. Some approaches are gaining more attention and may soon become more of an industry standard. See for example the Grameen Bank's Progress out of Poverty Index, PPI (Grameen Foundation, 2014).

The level of performance data, that is individual- versus group-level repayment, could also be enhanced in future studies. The empirical data from Sierra Leone has been primarily limited to loan repayment at the group level. This is driven by the lending institution's loan tracking software. Group lending institutions are typically not interested in the individual contributions, but only the group repayment. Ideally, one would also collect data at the individual level, both in terms of willingness and ability to pay. Such data would greatly enhance the ability to distinguish theoretical concepts related to group cooperation.

In closing, group lending remains an interesting research topic for two reasons. Theoretically, group lending is a topic at the heart of economic sociology. It places moral sentiments and economic interests side by side, and at times in opposition. Microfinance serves as a natural laboratory for understanding how humans make trade-offs between these interests. Practically, group lending in microfinance remains a highly debated topic. Is it necessary and beneficial? There are strong opinions on either side of this debate. Some argue that without group lending there would be no microfinance (MFI, 2007). Others suggest that this is not the case; transitioning away from group lending to individual contracts would have a minor impact on repayment and may promote microfinance outreach (Giné & Karlan, 2014). To make an informed decision, a better understanding of how group lending works in theory and in practice is needed. My intent for this dissertation has been to contribute a few needed brushstrokes to the emerging picture of microfinance.

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