

**Asymmetric Information and Social Networks
in Credit Markets: A Theoretical and
Empirical Study**

Asymmetric Information and Social Networks in Credit Markets: A Theoretical and Empirical Study

A thesis submitted to the Indian Institute of Technology Guwahati in
partial fulfilment of the requirements for the degree of Doctor of
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Submitted by

PALLABI CHAKRABORTY

Registration No. 176141008

Department of Humanities and Social Sciences

Indian Institute of Technology Guwahati

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Declaration

Indian Institute of Technology Guwahati
Department of Humanities and Social Sciences
Guwahati-781039, Assam, India



I hereby declare that the thesis titled **“Asymmetric Information and Social Networks in Credit Markets: A Theoretical and Empirical Study”** is the result of research work carried out by myself in the Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati, India, under the supervision of Dr. Amarjyoti Mahanta, Assistant Professor of Economics at the Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati, India.

In keeping with the general practice of reporting scientific observations, due acknowledgment has been made wherever the work described is based on findings of other investigations.

Pallabi Chakraborty

(**Pallabi Chakraborty**)

PhD Student, Department of Humanities and Social Sciences

Indian Institute of Technology, Guwahati

Place: IIT Guwahati

Date: 22-12-2022

Certificate

Indian Institute of Technology Guwahati
Department of Humanities and Social Sciences
Guwahati-781039, Assam, India



This is to certify that the thesis titled **“Asymmetric Information and Social Networks in Credit Markets: A Theoretical and Empirical Study”** submitted by Miss Pallabi Chakraborty for the Degree of Philosophy in Economics in the Department of Humanities and Social Sciences at the Indian Institute of Technology, Guwahati embodies bonafide record of research work carried out under my supervision and guidance.

The present thesis or any part thereof has not been submitted to any other University for the award of any degree or diploma. All assistance received by the researcher has been duly acknowledged.

Dr. Amarjyoti Mahanta

Thesis Supervisor

Assistant Professor of Economics, Department of Humanities and Social Sciences

Indian Institute of Technology, Guwahati

Place: IIT Guwahati

Date: 22-12-2022

Dedicated to my loving parents
Mr.Utpal Chakravarty & Mrs.Rupanjali Chakraborty
and to my loving brother Mr.Nilotpal Chakraborty



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*‘I owe everything to you, My Lord,
For sailing me through this phase of my life’*

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Contents

1	Introduction	14
1.1	Background and motivation	14
1.2	Data and Methodology	20
1.3	Brief outline of the dissertation	22
2	Asymmetric information, capacity constraint and segmentation in credit markets	29
2.1	Introduction	30
2.2	The model	32
2.3	Lenders as monopolist	35
2.4	Competition between lenders without capacity constraint	39
2.5	Competition between the lenders with moneylender having capacity constraint	44
2.6	Conclusion	57
3	The role of financial and physical assets as substitute or complementary to land as collateral in credit market: Evidence from Indian households	60
3.1	Introduction	61
3.2	Related literature	65
3.2.1	Land ownership and credit access in the formal sector	65
3.2.2	Land, other assets and credit access	66
3.2.3	Is there a limited use of land in credit market?	67
3.3	Methodology	70
3.3.1	Data Source	70
3.3.2	Econometric model	71
3.3.3	The identification strategy	74
3.3.4	Variables used in the study	75
3.4	Results and discussion	79

3.4.1	Selection model	80
3.4.2	Outcome model	84
3.4.3	IV estimation	87
3.4.4	IV estimation results	88
3.5	Conclusion	90
4	Friendship-kinship network and access to formal-informal credit in India	92
4.1	Introduction	92
4.2	Review of literature	98
4.2.1	Social network as a source of financial information	99
4.2.2	Social network as a monitoring and enforcement mechanism	100
4.2.3	Social network as a source of credit	101
4.3	Data and methodology	101
4.3.1	Conceptual framework	102
4.3.2	Regression specification	102
4.3.3	The identification strategy	103
4.3.4	Endogeneity concerns	104
4.3.5	Variables and descriptive statistics	106
4.4	Results	110
4.5	Channels between FR network and credit access	119
4.6	Conclusion	131
4.7	Appendix	134
5	Do political connections matter in loan repayment? Evidence from Indian households	136
5.1	Introduction	136
5.2	Related literature	140
5.2.1	Social networks and repayment in group lending programs	140
5.2.2	Social networks and repayment in context of individual liability loans . .	141
5.2.3	Political networks in credit access and repayment	142
5.2.4	Social networks and credit outcomes: the Indian case	142
5.3	Methodology	144
5.3.1	Data Source	144
5.3.2	Conceptual framework	144

5.3.3	The model	145
5.3.4	Outcome variable, treatment variable and control variables	146
5.3.5	The coarsening procedure	153
5.4	Results and discussion	154
5.4.1	Average treatment effect (ATE) and average treatment effect on the treated (ATET)	154
5.4.2	Effect of the control variables on loan repayment according to treatment status	157
5.4.3	Exploring channel(s) between political network and repayment	159
5.4.4	Robustness of results with different types of coarsening	162
5.4.5	Estimating causal effect of political network by land ownership status . .	164
5.5	Conclusion	166
5.6	Appendix	168
6	Conclusion	187
6.1	Policy Implications	190
6.2	Scope for improvement and future work	192
6.3	Conferences and Workshops	195
6.4	Publications	196

List of Tables

Chapter 3. The role of financial and physical assets as substitute or complementary to land as collateral in credit market: Evidence from Indian households

1. t test of means/proportions between approved and rejected households.....	72
2. Definition and summary statistics of variables.....	75
2a. Average loan size between landless and landed by credit source and occupation.....	78
3. Results of Heckprobit model.....	82-85

Chapter 4. Friendship-kinship network and access to formal-informal credit in India

1. Variables definition and summary statistics.....	107
2. Percentage distribution of amount of outstanding debt of HHs by different credit sectors.....	108
3. t-tests of means/proportions between applicants and non-applicants.....	109
4. Effect of FR network on access to bank credit.....	112-113
5. Effect of FR network on access to moneylender credit.....	115-116
6. Effect of FR network on access to MFI credit.....	118-119
7a. FR network and access to credit: the collateral channel.....	122
7b. FR network and access to credit: the collateral channel.....	124
8. FR network and access to credit: the political economy channel.....	128
9. FR network and access to credit: the social expenditure channel.....	130
10. Interaction effect of FR network with states.....	134-135

Chapter 5. Do political connections matter in loan repayment? Evidence from Indian households

1. List of variables used in the study	147-148
2. Summary statistics.....	150
3. t tests of means/proportions of covariates between treated and control groups.....	152
4. Matching summary.....	155
5. Treatment effect of political network on loan repayment.....	157
6. Mediation analysis (ATET).....	161
6. Mediation analysis (ATE).....	161
7. Treatment effects under alternative coarsening procedures.....	163
8. Heterogeneous treatment effects according to different categories of land ownership..	165
5A. Treatment model of political network using IPW estimator.....	168
5B. Reduced form model of political network.....	169-170
5C. Probit estimates of covariates on loan repayment according to treatment status...	171-172
6A. Mediation analysis estimates of covariates.....	173-174
7A. Probit estimates of covariates on loan repayment for the treated group.....	175-176
7B. Probit estimates of covariates on loan repayment for the control group.....	177-178
8A. Probit estimates of covariates on repayment for landed and landless.....	179-180
8B. Probit estimates of covariates on repayment for small & above and otherwise.....	181-182
8C. Probit estimates of covariates on repayment for semi-med & above and otherwise....	183-184
8D. Probit estimates of covariates on repayment for medium & above and otherwise.....	185-186

List of Figures

Chapter 1. Asymmetric information, capacity constraint and segmentation in credit markets

Figure 1. Participation constraints of borrower's and moneylender's profit function.....	36
Figure 2. Participation and incentive compatibility constraints for borrowers of bank....	37
Figure 3. Isoprofit curves of the bank.....	38



Chapter 1

Introduction

1.1 Background and motivation

The need for credit has been well documented in the literature. Credit is required to lift people out of poverty by way of enabling them to set-up business, to undertake any form investment that would lead to income generation, to invest in education and health, to smooth out consumption in uncertain environments and many more(Ray, 1998). The peculiarity and speciality of credit market is that lenders provide money today for a promise of return in the future. The borrower may not keep his/her promise, so there is a risk of default. Because of this the lender screens borrowers so that it lends only to those borrowers who are not going to run away with the credit. This makes lending a riskier activity compared to transactions of any other goods and services(Ray, 1998).

Lenders employ various methods to secure against adverse selection. The projects or purpose for which loans are taken may have different risks. The lender also does not want to have a profile that consists of only risky borrowers. In case of limited liability, the lender will not have enough if the borrower profile consists of risky and if their projects go bad. Associated with this issue is the problem of moral hazard and the lender has to ensure that the borrower uses the loan in the project for which it has borrowed and there is no diversion. Thus, the lender has to monitor borrowers in addition to screening(Hoff & Stiglitz, 1990). In presence of asymmetric information, lenders may use collateral in combination with rate of interest in order to screen borrowers according to their degree of riskiness(Besanko & Thakor, 1987). This is particularly true in case of formal lenders than informal lenders. Lenders can be classified into two categories, formal and informal. Formal lenders are those who neither have informa-

tion about relevant borrower characteristics nor use social ties to enforce repayment. Examples include bank and government agencies. Informal lenders, on the other hand, have an informational advantage regarding the types of borrowers vis-a-vis their formal counterparts and often utilize social ties to enforce repayment¹. Moneylenders, microfinance institutions(MFIs), landlords, traders, etc. fall under informal lenders(Andersen & Malchow-Møller, 2006; Jain, 1999; Karaivanov & Kessler, 2018).

In view of the observed coexistence of formal and informal credit sectors, the theoretical literature has identified two types of interaction between formal and informal lenders: horizontal and vertical. In case of horizontal interaction, formal and informal lenders are involved in competition for borrowers (Andersen & Malchow-Møller, 2006; S. Boucher & Guirking, 2007; Demont, 2016; Jain, 1999; Mookherjee & Motta, 2016). Vertical interaction refers to that kind of interplay between formal and informal lenders where informal lenders act as an intermediary between formal lenders (e.g., bank) and borrowers. They borrow funds from formal lenders and then re lend these to ultimate borrowers(P. Bose, 1998; Hoff & Stiglitz, 1998; Sagrario Floro & Ray, 1997). In contrast to studies that consider only either of the two linkages, Madestam (2014) presents a model incorporating both vertical and horizontal interactions between formal and informal lenders to show that informal lenders can either complement(increases borrowers' direct access to formal credit) or substitute for formal loan(reduce direct access to formal loans).

However, the studies that model strategic interaction between lenders assume that lenders earn zero profits at the equilibrium due to competition over interest rate(Bertrand Paradox). Further, such models make the assumption that borrowers differ only in their risk level, ignoring the fact that borrowers can differ in their wealth endowments. Another possibility is that when it comes to informal lenders such as moneylenders, they may have limited funds to lend unlike banks, a finding that has been echoed in the empirical literature. However, the existing theoretical models do not consider informal lenders to be constrained in loanable funds. Given this, when informal lenders compete with formal lenders for borrowers, their limited capacity may prevent them from serving the desired segment of borrowers. These are some gaps that have not been addressed by the available models. Thus, the second chapter of my thesis builds a model of strategic interaction between formal and informal lenders with the assumption that lenders maximize their profits. We show that there is an optimal contract at which both the

¹For instance, MFIs rely on the concept of peer monitoring, while moneylender or employer can use violent means to enforce repayment(Andersen & Malchow-Møller, 2006; Jain, 1999; Karaivanov & Kessler, 2018).

lenders earn positive profits and zero profit outcome is only one of the Nash equilibrium outcomes. We arrive at another important result from this study which is that whenever the moneylender has some form of capacity constraint, a zero-profit outcome is never a Nash equilibrium outcome. We contribute to the literature in that in our model we incorporate the assumption that borrowers differ along two characteristics: risk and wealth such that wealth is collateralizable. In this context, our model is close to Mookherjee and Motta (2016) who also assume that borrowers differ in their default risks and landholding, but in their model, a borrower's wealth (represented by landholdings) cannot be used as collateral. Our set-up allows us to examine whether borrowers are rationed by lenders based not only on their risk level but also on their wealth possession. The third contribution of this chapter is the assumption of capacity constraint of the informal lender (moneylender), which is motivated from the empirical literature that informal lenders are constrained by loanable funds unlike formal lenders such as banks (Conning & Udry, 2007; Zanin, 2017). In this case, we complement and contribute to Madestam (2014) who assumes that moneylender's capacity constraint is not binding because it is alleviated through borrowing from bank. However, in the set-up that we consider, moneylender's constraint is binding as it is involved in competition with the bank and thus cannot borrow from it. This provides another ground for understanding the nature of credit rationing when one of the lenders has capacity constraint.

There are evidences which suggest the pervasive use of collateral, especially of land collateral in India and in other developing countries. Land is considered as an ideal collateral due to its immobility which reduces lender's monitoring costs and due to its appropriability because in the event of default, it can be easily transferred and can be liquidated without incurring high costs to the lenders (Binswanger & Rosenzweig, 1986b; Feder & Feeny, 1991; Narayanan & Chakraborty, 2019; Sanjak, 2012). Further, when land is pledged as collateral, it lowers the chances of strategic default by borrowers. In case of India, D. Pal and Laha (2015), A. Kumar, Mishra, Saroj, and Joshi (2017) and others find a positive and significant relationship between volume of land ownership and the likelihood of getting formal credit. Elsewhere, studies with similar findings include Mohieldin and Wright (2000) in context of Egypt, Jia, Heidhues, and Zeller (2010) in case of China and Tsukada, Higashikata, and Takahashi (2010) in case of Indonesia to name a few. But, land as a collateral also has certain limitations. A major problem relates to the illiquid nature of land, especially in the rural areas which reduces the marketability of the asset, thus making it less effective as collateral (Binswanger & Rosenzweig, 1986a; Chakravorty, 2013; Feder & Feeny, 1991). A related problem is that sometimes land is

possessed in forms not acceptable as collateral (joint ownership of lands, encroachments, and temple lands, etc.). Similarly, land parcels transferred to farmers under land redistribution programmes of the government are often not marketable and hence cannot be used as collateral (Herath, 1996; Pender & Kerr, 1999). It is also a fact that developing countries are often characterized by structural bottlenecks (social, political factors) which may prevent foreclosure of land in case of default (Feder, Onchan, & Raparla, 1988; Krishnan & Panchapagesan, n.d.). For example, when a considerable fraction of borrowers default, it may lead to political unrest. Despite its associated problems, land is an important determinant of credit access particularly in the formal sector.

An important observation, however, is that borrowers with insufficient land and those without any ownership of land also get loans, and are hence not rationed. As per the second round of the Indian Human Development Survey (2011-12), among borrowers who managed to get a loan, a significant chunk (49.77%) are landless. In addition, a decent fraction of borrowers, about 36.05% who have got a formal loan are landless. This is where the question of how the landless segment get loans comes to the front. The third chapter of my thesis attempts to address this crucial question. We hypothesize that possession of assets other than land, for example, physical assets and financial assets may enable the landless households to get access to credit. In that case, such assets act as substitute to land. On the other hand, it could also be the case that these assets increase the chances of getting loan when they are combined with land, in which case they are complementary to land. In this chapter of the thesis, we explore the nature of association between land and other assets in credit access of borrower households in India. We also examine whether this relationship varies across formal and informal lenders. We address another important question in this chapter which relates to the nature of interaction between wealth of borrowers and the purpose with which they apply for a loan. An example would be as follows. Consider two applicants, one wealthy and the other poor and both of them apply for a business loan. A business loan has income generating potential in the immediate horizon unlike an educational or medical loan. If the chances are more that the lender grants loan to the wealthy, we can say that wealth and loan purpose are complementary. In other words, having more wealth reinforces the positive effect of a productive project on credit access, if any. We further examine this relationship in getting formal vis-à-vis informal loans. Previous studies have considered loan purpose as a variable in their model, but the possibility that loan purpose and wealth could be related is left unexplored. We address this question in the thesis.

We have so far discussed about market credit and institutions. But an important aspect of credit market is non-market institutions (NMIs). According to Arnott and Stiglitz (1991), the primary role of NMIs is to provide insurance to someone who has suffered some misfortune. In presence of market failures, NMIs emerge as a way to reduce the deficiencies of market insurance and these operate side by side to supplement incomplete market insurance. An example of this is social networks or connections. There can be different types of networks and one such network is connections with friends and relatives (FR network henceforth). In developing economies, it is commonly observed that borrowing from friends and relatives constitute an easily accessible form of credit for households. For illustration, consider a simple example. A borrower needs a loan of L units. The market rate of interest is r compounded annually. Then the interest payment due at the end of one year to the bank (say) is $L(1 + r)$. However, if the individual borrows X units ($X < L$) from his FR network, he may be eligible for the loan worth $(L - X)$ from the bank and the total interest payment is now $(L - X)(1 + r)$. In this manner, these connections may solve the rationing problem to some extent.

FR network may help borrowers in the following ways. Studies have shown the benefits that come with FR network. Friends and relatives may supply a fraction of credit requirement of borrowers and thus reduce rationing (Fafchamps & Gubert, 2007; Ferrara, 2003; Kinnan & Townsend, 2012). They may provide monetary support to borrowers to repay their loan on time, particularly in situations when their project goes bad. A good repayment history in turn is likely to increase credibility of borrowers enabling them to get a loan in the future. Further, FR network can be a source of financial information such as knowing the right place to borrow (Jiang, Sun, & Zhang, 2022; Okten & Osili, 2004; Y. Zhang, Lin, & Li, 2012) and it may serve as a monitoring and enforcement mechanism for other lenders (Sun, Hartarska, Zhang, & Nadolnyak, 2018; Venittelli, 2021; Y. Zhang et al., 2012). Despite the beneficial effects of friendship-kinship network, it is not without its own limitations (Karaivanov & Kessler, 2018; Lee & Persson, 2016; Muduli & Dash, 2019; Turvey & Kong, 2010). Lee and Persson (2016) suggest that a shadow cost is associated with family loans as borrowers must reciprocate through costly favours to maintain the relationship. The study by Turvey and Kong (2010) show that when trust between borrowers and their friendship-relative network is sufficiently high, then informal borrowing amongst them not only crowd out rural credit cooperatives, but also the registered micro-finance institutions (MFIs) which are designed for poor households in the rural and agricultural areas. Karaivanov and Kessler (2018) suggest that households weigh the relative costs and benefits of borrowing from friends/relatives vis-a-vis other sources.

Though loans from FR network substitute physical collateral and are usually interest free, the fear of losing social ties upon default may discourage borrowers to rely on their family and friend circle and instead choose formal loan.

It is evident from the existing studies that there is a possibility that loans from FR network may affect borrowers' participation in credit market. When borrowers strictly prefer borrowing from this network to borrowing from the market, then any attempt to expand of formal credit and micro-finance in India (and elsewhere) may be ineffective in areas where borrowers have a strong preference towards borrowing within their family and friend circle. Thus, in the the fourth chapter of the thesis we examine whether borrowing from FR network affects borrowing from formal and informal lenders in India. To be specific, we examine whether FR network increases the probability of loan application to and approval from bank, moneylender and microfinance institutions(MFIs), which are the three most dominant sources of credit for borrowers in India. An important contribution of our study is that we capture the FR network of borrowers with the help of a loan obtained from them in the empirical model. It not only indicates the mobilization of actual monetary resources in form of a loan from friends and relatives, but also represents a functional and an active network². We further examine various channels by which FR network can affect credit market participation of borrowers.

Apart from the issue of credit access, another important feature of credit market relates to repayment of loan. There are two reasons as to why borrowers repay: the hope of getting another loan in the future and to avoid punishment in the event of default. This is where the importance of institutions like legal framework in the economy comes into play. Closely linked with this is the prevailing political system in the economy. When borrowers are acquainted with politicians and people in the bureaucracy, they may have a tendency to default if the cost of default is sufficiently low and this is the case where political connections(networks) of borrowers exert a negative impact on loan repayment. However, the other situation arises when borrowers with these connections have a greater tendency to repay such that these connections bring in monetary resources or any other form of support that help in loan repayment, particularly when their project fails. Even when a borrower's project is a success, political connections may induce him to repay and prevent the likelihood of strategic default. Therefore, the fifth chapter of my thesis examines the nexus between political connections of households and their

²The number of cases of borrowing from friends and relatives is a better indicator of dependence on FR network than the amount borrowed((Muduli & Dash, 2019).

probability of loan repayment in the Indian context. We extend and contribute to the broad literature which examine the relationship between social networks and repayment in context of group lending programs and in case of firms in India and elsewhere. Specifically, we attempt to establish a causal link between political connections and repayment in the context of individual liability loans that pertains to each specific household, and is a topic that remains unexplored in the literature. We further explore channels that could mediate any significant association between connections and repayment.

1.2 Data and Methodology

We employ both theoretical and empirical strategies to address the objectives of our study. In the second chapter of the thesis, we build a game with the following specifications. We have a static (simultaneous move) one period game. There are two players: the bank and the moneylender. The strategies available to the lenders are repayment and collateral. The payoff is the profit obtained by each lender. The solution concept of Nash equilibrium is used to derive the optimal strategies of the lenders.

The third, fourth and fifth chapter of the thesis make use of secondary data to address the questions. The data employed is that of the second round of India Human Development Survey(2011-12)(Desai, Vanneman, et al., 2015). It is a nationally representative, multi-topic survey of 42,152 households in 1,503 villages and 971 urban neighborhoods across India. The sample size in each chapter has been chosen based upon the questions being addressed. In the third chapter, we employ a sample selection probit model. The dependent variable is the probability of loan approval in the first stage, followed by the probability of this loan being formal in the second stage. Accordingly, we resort to a truncated sample for the empirical analysis which consists only of applicants (23,699 households). Of this, the number of approved households stands at 22,630. In the fourth chapter, since we estimate the probability of loan application in the first stage followed by the probability of approval in the second stage, we consider the total sample size of 42,152 households. Finally, in the fifth chapter, we estimate the likelihood of loan repayment and therefore we restrict our analysis to the sample of households who have borrowed a loan. The sample consists of 22,630 borrower households.

We choose the India Human Development Survey(IHDS) data for our study over other similar data sets. The National Sample Survey Organization (NSSO) undertakes the All India Debt and Investment Survey (AIDIS) decennially, the latest round being conducted in 2019.

Another survey undertaken by the NSSO is the Situation Assessment Survey (SAS) of Agricultural Households which is specially devoted to collecting more exhaustive information on agricultural households in India. Both AIDIS and SAS provide information on debt and asset position of households, with the only difference that AIDIS includes all households while SAS includes only the agricultural households in India. The IHDS and AIDIS provide more or less similar information on debt scenario of Indian households and are comparable. However, the reason for choosing IHDS data source is that it provides some additional information which is not present in AIDIS data. First, one of the most important information relates to the loan application status of households, which is relevant for the empirical strategy adopted in our study. In particular, the third and fourth chapters of the thesis utilizes the information on whether or not a given household has applied for any loan. This variable reflects the demand side of credit access. If a household does not apply for any loan, it may be because it has no demand. In that case it will not be considered as credit rationed. Second, so far as social network variables are concerned, IHDS is the only secondary data source to provide rich information on many social capital variables. To be specific, the fourth and fifth chapters include network variables in estimating the respective econometric models. Therefore, the present study will stick to IHDS data source for carrying out the empirical analysis.

In addition, we limit ourselves to using only the second round of the survey due to some important considerations. First and most important, the first round does not provide the information to distinguish between households who do not have a demand for loan and hence did not apply and those who have a demand but their application got rejected. However, using the second wave of the survey, we could distinguish between these two types of households. We restrict our sample to the applicants and then proceed to examine whether or not they have got a loan and further, if they have got a loan what is the likelihood that they get it from the formal sector vis-à-vis the informal sector. This is important to understand credit rationing correctly as it involves both the application decision coming from the households and approval decision arising from the lenders. Second, the financial asset index (constructed with the financial instruments used by the households) is one of the key explanatory variables used in the empirical chapters of the thesis. Unfortunately, the first round does not contain this information. The second round does provide information on this variable relevant for our study. Third, the index of major event, which is used as an instrumental variable for physical asset index and for financial asset index in the third chapter is available only in the second round of the survey. Thus, the information on these variables which is crucial to address the objectives of our study is provided by the second round of the IHDS and therefore we restrict ourselves to using this round in the

present study.

1.3 Brief outline of the dissertation

Chapter 2

In the second chapter, we propose a model of competition between a formal lender (bank) and an informal lender (moneylender) with informational asymmetry between these two lenders. Further we introduce capacity constraint on the lending capacity of the moneylender. There is a continuum of risk and safe borrowers who differ in terms of their wealth. Our study shares some similarity with Mookherjee and Motta (2016) who consider borrowers to differ in risk and wealth and Madestam (2014) who assume capacity constraint on the part of the informal lender. But, there are some differences between the set-up of our model and that of these studies. In Mookherjee and Motta (2016), wealth level of borrowers (represented by landholdings) cannot be collateralized but it can be used as collateral in our model. Likewise, in Madestam (2014), the informal lender's capacity constraint is not binding as it is alleviated through borrowing from bank. However, in our model, the moneylender's constraint is binding as it is involved in competition with the bank and cannot borrow from it.

To determine the optimal strategies of the bank and the moneylender, we adopt the concept of Nash equilibrium since we have a single stage game between the two players.

The equilibrium strategies in most of the results depend on the difference between the expected returns from risky and safe projects where the risky project has higher expected returns. There occurs segmentation of the credit market in terms of risk and wealth of borrowers. Rationing of poor safe borrowers from the credit market is inevitable when the moneylender's capacity is sufficiently small, suggesting a low income trap for them. The novelty of our study lies in that unlike the previous literature on strategic interaction that assume zero profit (Bertrand Paradox) condition, the present study shows that zero profit is only one of the possible Nash equilibrium outcomes, in the case when the lenders do not have any capacity constraint. There is an optimal contract at which the lenders differentiate in terms of repayment and collateral and earn positive profits under certain condition. The condition is that when the difference between the expected returns from risky and safe borrowers (projects) is less than some threshold value, the lenders offer contracts at which they earn positive profits and borrowers are driven down to their reservation utility. Another important result from this study is that whenever there is some form of capacity constraint of the moneylender, a zero-profit outcome is never a Nash

equilibrium outcome. Though lenders compete, they need not come down to zero profits, unlike what has been commonly assumed in the existing theoretical literature.

Chapter 3

In the third chapter, we explore the nature of association between land ownership and other assets (physical and financial) in enabling credit access for Indian households. We examine this nexus in case of formal vis-a-vis informal credit sectors. As the second objective of this chapter, we examine if there is any relationship between the wealth variables (land, physical assets, financial assets) and the purpose of loan application which represents immediate and direct return from the project.

We use data from the second round(2011-12) of India Human Development Survey (IHDS) to address the objective in this chapter.

The empirical strategy involves the use of instrumental variables in a sample selection model. We suspect that physical assets and financial assets are endogenous in the model. One source of endogeneity is simultaneity where the dependent and independent variables are simultaneously affecting each other. Possession of assets may help to get a loan, which in turn can lead to acquisition of more assets. Another channel of endogeneity is that of omitted variable(s) which is (are) correlated both with the assets and the dependent variables. Therefore, we account for the possible endogeneity by using appropriate instruments for physical and financial assets. In the empirical model, we also address the possibility of sample selection bias. In our study, the source of the largest loan is observed only for the households who have managed to get a loan(approved applicants). Hence, there is a potential concern of endogenous or non-random selection into the pool of borrowers when the approved are characteristically different from the rejected applicants. We estimate a Heckman Probit model given by Van de Ven and Van Praag(1981) taking care of endogeneity issues through two stage least square methods.

The dependent variable in the first stage is a dummy taking a value 1 for applicants whose loan have been approved, and zero otherwise. In the second stage, the dependent variable is a dummy taking a value 1 for borrowers who obtained their largest credit from the formal sector, and zero if otherwise(informal sector). The main explanatory variables include volume of land ownership, index of physical assets, index of financial instruments and the purpose of the largest loan which takes a value 1 if the loan is obtained for productive purposes and zero otherwise. We use the following instruments for physical assets: a) an index of the major events experienced by the household in the last five years. These refer to shock(s) that resulted in

huge expenditure or loss of money such as major illness/accidents, drought/flood/fire, loss of job, marriage, crop failure, death and other loss, b) an index of wedding gifts prevalent in the community of the household. These include house/flat, car, fridge, utensils etc. For financial assets, we use three instruments: a) level of confidence the household has on the banking institutions to keep their money safe. It is a categorical variable with 0 denoting no confidence at all, 1 denoting some confidence and 2 indicating a good deal of confidence. The reference category is 0, b) an index of the major events experienced by the household in the last five years, c) an index of the benefits received from (or participation in) various social insurance schemes. It includes life insurance, health insurance, crop insurance, sanitary latrines or toilets, Kisan credit card, Indira Awas Yojana and girl child registration scheme. We include a host of control variables and state fixed effects to minimize bias due to omitted variables and to account for any unobserved time invariant variability across states.

Results from the empirical exercise reveal some new patterns. Both physical assets and financial assets increase the probability of getting formal credit for the landless, suggesting a substitution role. Further, a complementarity is observed between land ownership and financial instruments, and between land ownership and loan purpose, especially productive investments in case of formal credit market. We also find an interesting pattern of association between occupation status of borrowers and their credit access, this relationship being centered on land ownership. On one hand, households engaged in salaried jobs and other allied professions and on the other hand, the labourer class and those involved in low income jobs both have lower chances to get a loan, and particularly to get formal loan relative to the households engaged in cultivation and allied agriculture. We argue that these two categories of households make up about 97.07% of the landless borrowers, and their average size of land ownership is much smaller than the cultivators and the allied class, and this may lower their probability of credit access. However, our results suggest that being landless need not necessarily be a constraint for these borrowers, since we find evidence of substitutability of land ownership with financial and physical assets.

Chapter 4

The fourth chapter looks into the importance of non-market institutions as proxied by friendship-relative network(FR network) on credit access of households in India. We examine whether a loan from FR network of borrowers has any impact on their likelihood of application to formal and informal credit sectors, viz, banks, Microfinance institutions(MFIs) and moneylenders as

well as the probability of approval from these sources in India. We further explore different mechanisms through which FR network can affect the outcomes of our interest namely, collateral substitution channel, political economy channel and social expenditure channel.

We employ data from the second round(2011-12) of India Human Development Survey (IHDS). The empirical strategy involves inclusion of both the demand side (application) and supply side (approval) of credit access. Modeling these separately may lead to selection bias if the pool of applicants and non-applicants differ significantly in their characteristics. Another source of bias may result from unobserved factors which are correlated with both the probability of application and the probability of approval. Accordingly, we employ a Probit model with sample selection given by Van de Ven and Van Praag(1981) which applies to when both dependent variables are binary. Moreover, the explanatory variable FR network is likely to be endogenous in our model. This could be due to omitted variables or unobservable factors which simultaneously affect both the probability of taking loans from friends or relatives, and the probability that a household apply and get a loan from other lenders. Another possible source is that of reverse causality where having or not having a loan from other lenders (bank, moneylender or MFI) may determine whether the household borrows from its FR network. To address these concerns, we augment the sample selection model with an instrumental variable (IV) framework. We use three instruments, namely, the size of the household, marriage status and participation in public meetings by any member or members in the household. The instruments are chosen such that these have good correlation with the probability of having an FR loan but do not directly affect the probabilities of applying and accessing credit from the other sources.

The dependent variables include a dummy indicating whether or not a given household has applied for any loan from a particular credit source in the first stage, and a dummy indicating whether or not the loan has been approved conditional on application, in the second stage of the model. The main independent variable includes the FR network dummy which takes a value 1 for households who have taken any loan(s) from their FR network and zero otherwise. We include a host of control variables and state fixed effects to minimize bias due to omitted variables and to account for any unobserved time invariant variability across states.

We provide some new evidences on the relationship between FR network and access to formal and informal credit. First, households who have borrowed from their FR network are more likely to apply to both formal (bank and MFI) and informal (moneylender) lenders relative to borrowers without an FR loan. A possible explanation could be the following. If a borrower has a certain demand for loan and can get a smaller amount of loan with his available collateral, he is rationed in the amount of loan. However, if he borrows some amount from his FR network,

he may be able to borrow the remaining credit demand from say bank, with his available collateral. Another possible reason is that with the availability of credit from a second source (FR loan here), it may increase a borrower's credit demand from bank, moneylender or MFIs in presence of new investment opportunities (Demont, 2016; Islam, Nguyen, & Smyth, 2015). FR network may also provide borrowers with useful financial information which may encourage them to apply to other sectors. Second, we find that a loan from friends/relatives reduces the probability of approval from bank, which is counter-intuitive. On further exploring the pattern of FR loan use among the states of India, we find that there are six states (Haryana, Meghalaya, Assam, Orissa, Madhya Pradesh and Karnataka) for which the coefficient of FR loan on bank loan approval is negative and significant. A probable explanation is that in case of these six states, households with a loan from their FR network demand a higher amount of credit from bank, which makes it more likely that their chances of loan approval goes down vis-a-vis those without an FR loan. Another likely explanation is that households who are denied bank credit borrow from their FR network, suggesting reverse causality.

We also find some evidence of various channels by which FR network affects credit access in case of different lenders. First, a complementary association is observed between FR network and size of land ownership of borrowers. Specifically, households with an FR loan and those owning more than 4.94 acres of land (semi-medium and above group) have a higher likelihood of applying to bank, moneylender and MFI relative to the landless, the marginal and the small landowners (base group) or those without an FR loan or both. This is consistent with the perceived importance of land as collateral among borrowers. One possible argument is that FR network alleviates risk rationing for the land rich borrowers and/or it may reduce quantity rationing of borrowers. Further, we find that MFIs are more likely to grant credit to the poorer segment of the society, comprising of the landless and marginal land owners vis-a-vis the land rich households. Second, FR network is complementary to political network when it comes to getting a loan from bank. Political network itself is insignificant but increase access to formal loan in presence of an active FR network. Thus informal networks are more useful when these are political. We argue that some of the networks, especially friends can be formed through political connections, and in turn, these connections enable a borrower to obtain formal credit. This finding has important implications in India where political power determines access to various social schemes for the poor. Third, this study also finds that FR network increases the likelihood of loan application to moneylender for households who have a higher social spending, on average. An important intuition is that these households have a costly network or a large network to maintain. Since moneylender credit is more expensive than bank or MFI credit,

these households may use their costly network to borrow from moneylender. This finding points to the insufficient penetration of banks and of microfinance institutions.

Chapter 5

In the fifth chapter, we examine the causal relationship between political connections of borrower households and their probability of loan repayment in case of India. We also explore possible channels, that is, government schemes which could mediate the relationship between political network and loan repayment.

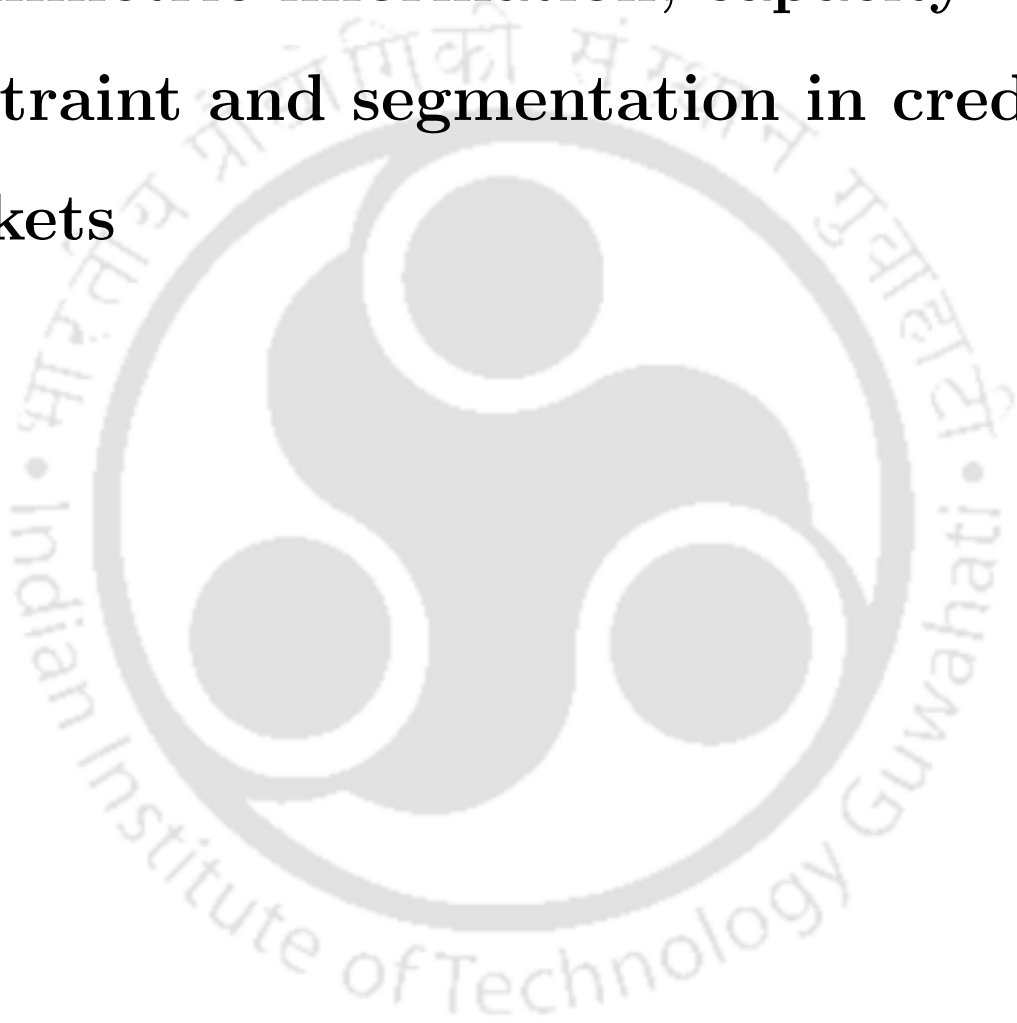
To address these questions, we use a nationally representative data, the India Human Development Survey (IHDS) and utilize information from the second round(2011-12) of this survey. The econometric method adopted to address the objectives involves a two step process. First, the treatment variable(political network) is likely to be non-random and there could be self-selection of borrowers into receiving the treatment. Therefore, to estimate the treatment effect, we employ the technique of coarsened exact matching (CEM). The advantage of CEM over other matching methods is that it balances the observations in the treated and the control groups by conditioning on a subset of the covariates and hence solves the problem of ‘curse of-dimensionality’ problem where exactly matching on all variables leads to a smaller sample size. However, the treatment effect may still be biased if the conditional independence assumption (CIA) is violated, that is, after conditioning on the observed covariates, treatment status and potential outcomes are no longer independent. One likely source of this is that unobserved factors (for e.g., peer effects or unobserved family traits) may simultaneously affect a household’s decision to get politically connected and its loan repayment. Thus, the political network variable is likely to be endogenous. We address this issue by employing an instrumental variables regression on the matched sample. The two step approach effectively takes care of any confounding effect arising from both observable as well as unobservable factors and provide us with a true causal effect.

In this study, the dependent (outcome) variable is ‘loan repaid’ which is a dummy taking a value 1 if a given household has repaid its largest loan, and zero otherwise. The treatment variable is political network. It is a dummy variable taking value 1 if any member in the household has joined political party or if there is any panchayat member/official in the household or close to the household, and zero otherwise. We consider government schemes as a mediator variable in the model. A mediating variable is one which describe the process by which the indepen-

dent variable affects the dependent variable (Baron & Kenny, 1986; MacKinnon, 2011). It is a dummy variable taking a value 1 if the household has access to any government life, health or crop insurance, toilets, Kisan credit card, housing schemes such as Indira Awas Yojana or girl child registration scheme, and takes a value zero otherwise. We instrument political network dummy with two variables: the level of confidence the household has in politicians/political party members or panchayat members to solve the local problems in their community and the number of years the household has resided in its current locality. We control for a number of explanatory variables in the model to reduce the possibility of omitted variable bias. These can be clubbed as a) household characteristics which include demographic characteristics and wealth position b) loan variables and c) networks other than political connections. We also include state fixed effects (by including dummies for states) in our model to account for possible variation across states in terms of political atmosphere, level of economic development, law and order situation, and to account for any unobserved time invariant variability across states. Results suggest that households that are politically connected have significantly higher probabilities to repay their loan vis-a-vis borrowers without connections. The mediation analysis using government schemes as the mediator variable reveals some important findings. Political connections increase the likelihood of getting access to various schemes of the government and these may be expected to bring in resources to households facilitating their repayment. There is evidence of partial mediation of government schemes on the relationship of our interest. Overall, this chapter highlights that there is limited evidence of political clientelism on repayment. Political connections instead discipline borrowers to repay their loan.

Chapter 2

**Asymmetric information, capacity
constraint and segmentation in credit
markets**



2.1 Introduction

The dual structured nature of credit market is a common feature in developing countries. Formal and informal lenders¹ coexist catering to credit needs of different types of borrowers at quite different interest rates(Conning & Udry, 2007; Pham & Lensink, 2007). This coexistence has been modelled in two ways in the theoretical literature. On one hand, models of horizontal interaction suggest that formal and informal lenders compete for borrowers and in the process may crowd out each other(Andersen & Malchow-Møller, 2006; Jain, 1999; Mookherjee & Motta, 2016). On the other hand, models of vertical interaction rest on the idea that formal lenders do not reach out to their clients directly, rather hire informal lenders as intermediaries and disburse funds to them who then re-lend to borrowers(P. Bose, 1998; Hoff & Stiglitz, 1998; Madestam, 2014; Sagrario Floro & Ray, 1997). The empirical evidences from the developing economies are consistent with the theoretical predictions. These studies suggest that formal and informal lenders could coexist due to two reasons. First, informal sector acts as the recipient of spill-over demand for borrowers who apply for formal credit but are rejected(Bell, Srinivasan, & Udry, 1997; Giné, 2011; Kochar, 1997; D. Pal & Laha, 2015; S. Pal, 2002). Second, informal sector can be the sector of choice for risk-rationed borrowers who fear losing their asset in the event of default and for those discouraged to apply in the formal sector(S. Boucher & Guirking, 2007; Guirking, 2008; Zanin, 2017).

We present an explanation for credit market segmentation which arises from information asymmetry between the bank (the formal lender) and the moneylender(the informal lender). The moneylender can distinguish between two types of borrowers, one type with a more risky project (risky) and the other type with a less risky project (safe) while the bank cannot distinguish between them. Both the lenders know the wealth level of the borrowers. Borrowers differ in risk and wealth, and wealth can be collateralized. Our model addresses the screening problem, i.e.,the problem of adverse selection faced by the bank. As the bank cannot distinguish between safe and risky borrowers there arises a possibility that it ends up serving a pool of borrowers which reduces its expected profits.

We contribute to the literature on strategic interaction between formal and informal lenders in the following ways. First, we consider two dimensions along which borrowers differ, risk and wealth. Though models of horizontal interaction assume borrowers to differ in risks, that

¹We follow the definition given in the literature that informal lenders possess information about borrower types and actions, while formal lenders do not(Andersen & Malchow-Møller, 2006; Jain, 1999; Mookherjee & Motta, 2016).

borrowers could also differ in their wealth endowments has not been explicitly considered by previous studies. One exception, however, is Mookherjee and Motta(2016) who build a model of interaction between a microfinance institution and informal lenders assuming that borrowers differ in their default risks and landholding. But we differ from them in that while in their model wealth cannot be collateralized though it can be put to production, we assume that wealth of borrowers can be collateralized. Our set-up allows us to examine the nature of credit rationing, specifically if borrowers are sorted across lenders based on wealth. Our second contribution to the literature is that we allow the informal lender to be constrained by capacity. This consideration is motivated from empirical studies which suggest that informal lenders usually have limited resources as compared with their formal counterparts(Conning & Udry, 2007; Zanin, 2017). Our model is somewhat close to Madestam (2014) who also assumes capacity constraint of the moneylender. However, in Madestam(2014), moneylender's capacity constraint is not binding because it is alleviated through borrowing from bank whenever required. Unlike his model, we incorporate capacity constraint of the moneylender in a set-up of horizontal interaction where it cannot borrow from the bank making the capacity constraint to be a binding constraint. Further, his model is that of ex-ante moral hazard in which the bank utilizes the moneylender's information advantage to prevent non-diligent behaviour of borrowers. However, in our model the bank cannot make use of the moneylender's information to screen borrowers. With these specifications we examine the nature of rationing in the credit market.

In equilibrium, we get a segmented outcome where each lender serves a particular segment of borrowers in terms of wealth. However, when moneylender's capacity is constrained, there also occurs segmentation in terms of risk under certain conditions. This result is similar to that in Andersen and Moller(2006). However, they arrive at a segmented outcome due to reasons different from ours. In Andersen and Moller(2006), borrowers do not have wealth that can be collateralized; rather bank utilizes moneylender's information to screen borrowers while moneylender utilizes bank's cost advantage to finance borrowers at lower costs. This results in a segmented equilibrium such that all risky are served by the bank and all safe are served by the moneylender. On the other hand, we arrive at a segmented equilibrium due to presence of wealth (collateral) which the bank uses to screen borrowers. Relatively wealthier borrowers are served by the bank while the moneylender serves the poorer segment rationed by the bank which is ubiquitous in Indian economy. This result is similar to studies like Bardsley and Meager (2019), Ding and Abdulai (2020), Meager (2019, 2022), and Wang (2022) which find that there is always a segment of borrowers in the economy who are rationed, leading to a vicious circle.

This study also extends the literature on strategic interaction between formal and informal lenders. In the literature when there is competition between lenders, results are derived in the case of zero profit (Bertrand Paradox) earned by lenders. These studies include Demont (2016); Meager (2022); Wang (2022), etc.. But we show that there is an optimal contract at which both the lenders earn positive profits and zero profit outcome is only one of the Nash equilibrium outcomes. We show that the lenders can differentiate in terms of repayment and collateral which enable them to earn positive profit under certain conditions. Another important result of our study is that whenever the moneylender has some form of capacity constraint, a zero-profit outcome is never a Nash equilibrium outcome. Though lender's compete, they need not come down to zero profits, unlike what has been commonly assumed in the existing theoretical literature.

The rest of the chapter is structured as follows. Section 2.2 sets out the basic model. Section 2.3 derives the profit maximizing contracts for lenders assuming that they operate as monopolists. Section 2.4 derives the Nash equilibrium outcome when lenders are involved in strategic interaction with each other and do not have capacity constraint. Section 2.5 considers strategic interaction when the moneylender has capacity constraint. The last section concludes with a discussion of the results.

2.2 The model

The economy comprises of three types of risk neutral agents : a bank, a moneylender and the borrowers. There are two types of risk neutral borrowers. One type has a more risky project and the other types has a less risky project. We refer to the first type as risky and the second type as safe in our study henceforth². Hence, borrowers can be either safe (s) or risky (r). A safe borrower has a greater probability of success than a risky borrower. In the model p_s and p_r denote the success probabilities of a safe borrower and of a risky borrower respectively with the assumption that $p_s > p_r$. In the success state, y_s and y_r denote project yields to safe and risky respectively. In the failure state, all projects yield zero return. There is a continuum of each type of borrowers based on wealth level, who are uniformly located along the interval $[0,1]$. We denote wealth of a borrower as ' w ' and assume $w \in [0,1]$. The wealth level is lowest when w takes a value zero and highest when it takes a value one. Wealth is collateralizable. Borrowers have a project in hand which requires an investment of ' L '. Loan contracts are exclusive, i.e., a

²Demont (2016) adopts a similar definition of risk types in his model.

borrower can borrow from only one lender. We thereby rule out double-dipping³ in our model⁴. The lenders make an all or nothing decision: finance L or nothing. In this way we rule out partial rationing from our model. We assume that the moneylender can distinguish between a safe borrower and a risky borrower, while the bank cannot. This brings in asymmetry of information into our model. However, wealth level is observable to both lenders. All borrowers have the same outside option v , which is their income from participating in activities other than investing in their projects by borrowing. We assume limited liability with respect to credit contracts, which means that the lender(s) cannot charge anything more than the collateral in the state of failure of the activity for which loan is taken. We further assume that there is no strategic default on the part of the borrowers.

The game is specified in the following way. The game is played simultaneously only once between the moneylender and the bank. The strategy of each lender is to offer a contract to borrowers who are given loan of L amount⁵. The contract consists of repayment amount (R_i) and collateral (C_i) where i denotes the borrower type, risky or safe. When the project is successful, the borrower repays the lender, which is inclusive of interest rate and the principal amount. In the state of failure, the lender can seize the collateral, if any. The strategy set of the moneylender is $\{(R_i^M, C_i^M) : R_i^M \in [0, \hat{R}_i] \text{ and } C_i^M \in [0, \hat{C}_i]\}$, $i = r, s$. The strategy set of the bank is $\{(R_i^B, C_i^B) : R_i^B \in [0, \hat{R}_i] \text{ and } C_i^B \in [0, \hat{C}_i]\}$, $i = r, s$. Here $\hat{R}_i$ and $\hat{C}_i$ are positive real numbers such that $\hat{R}_r \leq y_r$ and $\hat{R}_s \leq y_s$ and $\hat{C}_i \leq 1, i = r, s$. We consider $\hat{C}_i$ as same for both safe and risky because $\hat{C}_i \in [0, 1]$ represents wealth of borrowers.

While choosing the repayment amount and collateral, the lenders may compete to get higher share of both types of borrowers or they may not compete but segment the market in terms of wealth of the borrowers and act as monopoly lender in their own segment.

Since the bank cannot distinguish between safe and risky, it is possible that one type mimics the other. Thus, the profit maximization problem of the bank must satisfy two constraints, the participation constraint(PC) which means that the borrowers must get at least their opportunity cost v by borrowing; and the incentive compatibility constraint(ICC) which ensures that neither the safe type nor risky type mimics the other. However, the moneylender only needs to

³Double-dipping refers to a situation when a borrower takes loans from multiple sources(Guha & Chowdhury, 2013)

⁴In a study from Jharkhand, Demont (2016) finds that partial funding of projects is very rare due to diverse lending policies followed by different lenders. His theoretical model also assumes an exclusive contract. Berg, Emran, and Shilpi (2015) suggest the same in their study.

⁵See for example, Demont (2016) who assumes that lenders offer the same contract to all borrowers.

ensure that borrowers participate in the loan scheme. The optimization problem of the lenders are given below.

For a representative borrower of type i , the optimization problem for the moneylender is,

Maximize,

$$\pi_i^M = p_i R_i^M + (1 - p_i) C_i^M - L$$

subject to,

$$p_i(y_i - R_i^M) - (1 - p_i)C_i^M \geq v, i = r, s. \text{ (participation constraint)}$$

The optimization problem of the bank takes the following form,

Maximize,

$$\pi_i^B = p_i R_i^B + (1 - p_i) C_i^B - L$$

subject to,

$$p_i(y_i - R_i^B) - (1 - p_i)C_i^B \geq v \text{ (participation constraint)}$$

$$p_i(y_i - R_i^B) - (1 - p_i)C_i^B \geq p_i(y_i - R_j^B) - (1 - p_i)C_j^B, i \neq j; i, j = r, s \text{ (Incentive compatibility constraint)}$$

We make the following technical assumptions:

- 1) $p_r y_r \geq p_s y_s$. It states that the expected return from a risky borrower's project is at least equal to the expected return from a safe borrower's project, if successful. This is what makes a risky project attractive to take up.
- 2) $p_i y_i > v + L, i = r, s$. This assumption states that the expected return from a project is sufficiently high to cover the loan amount (L) and borrower's opportunity cost (v).
- 3) $\frac{p_s y_s - v}{1 - p_s} > \frac{p_r y_r - v}{1 - p_r}$. This together with $p_s > p_r$ ensures that the participation (and incentive compatibility) constraints of safe and risky borrowers cross at a single point and the constraints of the safe borrowers are steeper than that of the risky.
- 4) When the borrowers are indifferent between the contracts of the bank and of the moneylender, we assume that the borrowers choose the contract offered by the bank. This assumption is motivated from previous studies (Andersen & Malchow-Møller, 2006; Jain, 1999; Kochar, 1997; S. M. Kumar & Venkatachalam, 2019).
- 5) We make further assumptions in section 2.5 when we consider capacity constraint of the moneylender.

We first derive the optimal contracts when each lender is a monopolist.

2.3 Lenders as monopolist

When a lender behaves like a monopoly, the contract is designed to extract all surplus from its borrowers. This essentially means that borrowers are driven down to their reservation utility.

Moneylender

Due to its ability to distinguish between safe and risky types, borrowers cannot deceive the moneylender. So the incentive compatibility constraint is not required. The participation constraints for safe and risky borrowers are:

$$p_s(y_s - R_s^M) - (1 - p_s)C_s^M \geq v \dots (1a)$$

$$p_r(y_r - R_r^M) - (1 - p_r)C_r^M \geq v \dots (1b)$$

We derive the optimal contract in the following lemma.

Lemma 2.3.1. *When the moneylender is a monopoly lender, the optimal contract is $(R_i^M, C_i^M) = (\frac{p_i y_i - v}{p_i}, 0)$ for each i type of borrower, $i = r, s$.*

Proof. When the borrowers are at their reservation utility v , the PCs given by (1a) and (1b) hold with equality. Then, the moneylender's profits at any positive collateral $C_i^M, i = r, s$ are, $\pi_i^M = [p_i R_i^M + (1 - p_i)C_i^M - L](1 - C_i^M) = (p_i y_i - v - L)(1 - C_i^M)$, where $(1 - C_i^M)$ is moneylender's market share for borrowers of type i and i =risky, safe. The expression inside the bracket is obtained by rearranging the terms in the participation constraints. The profits when $C_i^M = 0$ are, $\pi_i^M = [p_i R_i^M + (1 - p_i) * 0 - L] * 1 = (p_i y_i - v - L), i = r, s$.

Clearly, the profits are larger in the second case, due to increased market share resulting from the zero collateral contract. The optimal contract is obtained by putting $C_i^M = 0$ in the participation constraint.

$$\Rightarrow p_i(y_i - R_i^M) - (1 - p_i) \times 0 = v$$

$$\Rightarrow R_i^M = \frac{p_i y_i - v}{p_i}, i = r, s.$$

Thus the moneylender's contract for safe and risky borrowers, when it operates as monopolist are given by $(\frac{p_s y_s - v}{p_s}, 0)$ and $(\frac{p_r y_r - v}{p_r}, 0)$ respectively.

□

Thus, the profits of the moneylender are maximized if it offers a zero collateral contract to both types of borrowers. It serves all safe and risky borrowers in the absence of any rival lender. An important implication of this result is that the moneylender does not require collateral to offer separate contracts to the risky and the safe borrowers because of its informational advantage. In figure 1 below, the optimal contract of the moneylender is shown. The participation

constraints of the safe and the risky borrowers are denoted by the thin and thick lines respectively. These also represent the iso-profit curve of the moneylender. Profits are increasing to the rightward direction, i.e., profit increases with increase in repayment for any given level of collateral.

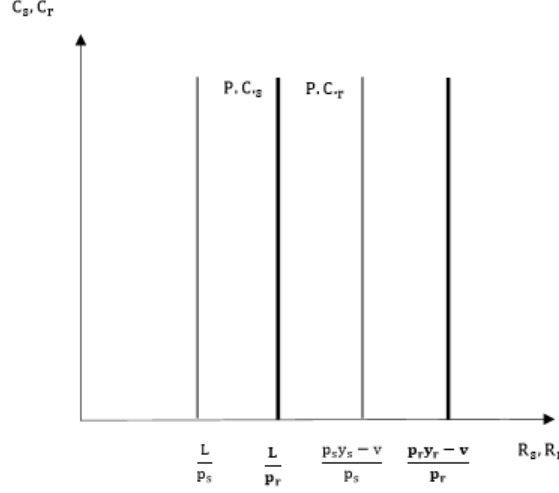


Figure 1: participation constraints of borrowers and moneylender's profit function

Remark 1. Note that the repayment for risky exceeds that for the safe. Since $p_s > p_r$ and $p_r y_r \geq p_s y_s$, therefore $\frac{p_r y_r - v}{p_r} > \frac{p_s y_s - v}{p_s}$.

Bank

The participation constraints of the bank with respect to the safe and the risky borrowers are given as follows,

$$p_s(y_s - R_s^B) - (1 - p_s)C_s^B \geq v \dots (2a)$$

$$p_r(y_r - R_r^B) - (1 - p_r)C_r^B \geq v \dots (2b)$$

The incentive compatibility constraints (ICC) are,

$$p_s(y_s - R_s^B) - (1 - p_s)C_s^B \geq p_s(y_s - R_r^B) - (1 - p_s)C_r^B \dots (3a)$$

$$p_r(y_r - R_r^B) - (1 - p_r)C_r^B \geq p_r(y_r - R_s^B) - (1 - p_r)C_s^B \dots (3b)$$

Bank must offer contracts involving both repayment and collateral for at least one type to ensure self-selection (ICC). If contracts for both types involve only repayment, the risky would

mimic the safe and hence these will not be incentive compatible. Suppose bank offers zero collateral contract to both safe and risky. These contracts would be $(\frac{p_s y_s - v}{p_s}, 0)$ and $(\frac{p_r y_r - v}{p_r}, 0)$. Since $\frac{p_s y_s - v}{p_s} < \frac{p_r y_r - v}{p_r}$, risky would mimic the safe, as the expected utility is more than v . That is,

$$U_r = p_r y_r - p_r \left(\frac{p_s y_s - v}{p_s} \right) - (1 - p_r) * 0 - v = p_r y_r - v - \frac{p_r}{p_s} (p_s y_s - v) > 0, \text{ since } p_r y_r \geq p_s y_s \text{ and } p_r < p_s.$$

The profit of bank from the risky borrower is less, if there is mimicking.

$$\pi_r^B = \frac{p_r}{p_s} (p_s y_s - v) - L < p_r y_r - v - L.$$

This necessitates the bank to use collateral in order to screen borrowers. Figure 2 shows the constraints. When the bank is a monopoly lender, it offers contracts such that the borrowers are at the level of reservation utility. Since there is a problem of incentive compatibility, a risky borrower, for instance, will find it profitable to take up a safe guy's contract only when he expects to get more than v . In this case, for each type of borrower, the ICC is parallel to the PC but lie below the PC [fig 2 (a)]. Therefore, the contracts must be such that each type of borrower is getting exactly v and there is no incentive to mimic. Thus, both the constraints must coincide [fig 2 (b)].

The isoprofit curves of the bank are shown in figure 3. The thin and thick lines represent the

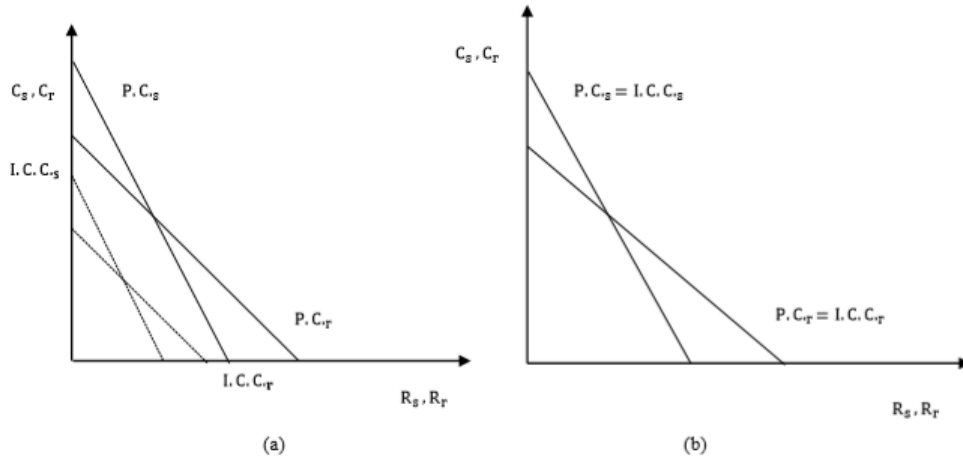


Figure 2: participation and incentive compatibility constraints for borrowers of bank

bank profits from safe and risky borrowers respectively. The total profits are increasing to the right. This suggests that profits from safe types are maximized at the point of intersection of the two participation constraints, while for risky types, a contract at the horizontal axis (where collateral is zero) would maximize the profits of the bank.

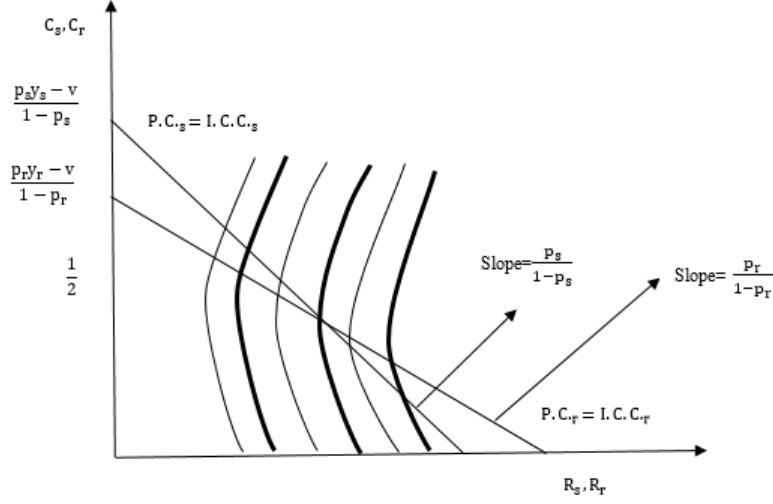


Figure 3: isoprofit curves of the bank

We denote $(\bar{R}, \bar{C})$ as the common contract obtained by solving the two participation constraints (2a) and (2b) holding with equality. Solving these two equations we have, $\bar{R} = [\frac{p_s y_s (1 - p_r) - p_r y_r (1 - p_s)}{p_s - p_r}] - v$ and $\bar{C} = [\frac{p_s p_r (y_r - y_s)}{p_s - p_r}] - v$. At this contract the bank serves $(1 - \bar{C})$ segment of safe types. These are the borrowers with minimum wealth level of $\bar{C}$. On the other hand, the contract offered to the risky types is $(\frac{p_r y_r - v}{p_r}, 0)$. This contract is affordable to all risky irrespective of their wealth level. Total profits to the bank at these contracts are,

$$\begin{aligned} & \pi_s^B(\bar{R}, \bar{C}) + \pi_r^B(\frac{p_r y_r - v}{p_r}, 0) \\ &= [p_s \bar{R} + (1 - p_s) \bar{C}] - L(1 - \bar{C}) + (p_r y_r - v - L) \\ &= (p_s y_s - v - L)[1 - \bar{C}] + (p_r y_r - v - L) \end{aligned}$$

The above constitute the optimal solution because all the borrowers are driven down to their reservation utility and there is no tendency to mimic by either type. One can easily see from figure 3 that if a safe type takes up a risky guy's contract, his utility would necessarily fall, in fact becomes negative so that he would not mimic. At the same time a risky would be indifferent between his own contract and a safe's contract because both the contracts lie on the same line.

$$\begin{aligned} U_s^B(\bar{R}, \bar{C}) &= 0 > p_s y_s - v - \frac{p_s}{p_r} * (p_r y_r - v) = U_s^B(\frac{p_r y_r - v}{p_r}, 0) \\ U_r^B(\bar{R}, \bar{C}) &= 0 = U_r^B(\frac{p_r y_r - v}{p_r}, 0) \end{aligned}$$

There can be another possible outcome for the bank. It can offer a pooling contract $(\frac{p_s y_s - v}{p_s}, 0)$ to both safe and risky types such that it is binding for the safe types but unbinding for the risky types. The profits to the bank from the pooling contract are,

$$\begin{aligned}\pi_{pooling}^B &= p_s \left[\frac{p_s y_s - v}{p_s} \right] - L + p_r \left[\frac{p_s y_s - v}{p_s} \right] - L \\ &= (p_s + p_r) \left[\frac{p_s y_s - v}{p_s} \right] - 2L\end{aligned}$$

We compare the bank profits from the separating equilibrium with the profits from the pooling equilibrium. The following condition ensures that the separating contract dominates the pooling contract.

Suppose, $\pi_{separating}^B > \pi_{pooling}^B$

$$\begin{aligned}\Rightarrow (p_s y_s - v - L)[1 - \bar{C}] + (p_r y_r - v - L) &> (p_s + p_r) \left[\frac{p_s y_s - v}{p_s} \right] - 2L \\ \Rightarrow (p_s y_s - v) + (p_r y_r - v) - \bar{C}[(p_s y_s - v - L)] &> (p_s y_s - v) + p_r \left[\frac{p_s y_s - v}{p_s} \right] \\ \Rightarrow (p_r y_r - v) - \frac{p_r}{p_s}(p_s y_s - v) &> \bar{C}[(p_s y_s - v - L)] \\ \Rightarrow \frac{p_s(p_r y_r - v) - p_r(p_s y_s - v)}{p_s} &> \bar{C}[(p_s y_s - v - L)]\end{aligned}$$

We plug in the expression for $\bar{C}$ from above and get,

$$\begin{aligned}\Rightarrow \frac{p_s(p_r y_r - v) - p_r(p_s y_s - v)}{p_s} &> \left[\frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \right] (p_s y_s - v - L) \\ \Rightarrow \frac{p_s p_r (y_r - y_s) - v(p_s - p_r)}{p_s} &> \left[\frac{p_s p_r (y_r - y_s) - v(p_s - p_r)}{p_s - p_r} \right] (p_s y_s - v - L) \\ \Rightarrow \frac{p_s - p_r}{p_s} &> p_s y_s - v - L\end{aligned}$$

We present the above result in the following Lemma.

Lemma 2.3.2. *When the bank is a monopoly lender, if $\frac{p_s - p_r}{p_s} > p_s y_s - v - L$, then the optimal contracts are the following;*

- a) For safe borrower $(R_s^B, C_s^B) = \left(\left[\frac{p_s y_s (1 - p_r) - p_r y_r (1 - p_s)}{p_s - p_r} \right] - v, \left[\frac{p_s p_r (y_r - y_s)}{p_s - p_r} \right] - v \right)$
- b) For risky borrower $(R_r^B, C_r^B) = \left(\frac{p_r y_r - v}{p_r}, 0 \right)$.

Thus, collateral serves as a screening instrument for the bank to deal with its informational problem. A consequence of this is rationing of the poorer safe borrowers in the formal credit sector. In the subsequent analysis, we observe a similar use of collateral by the bank for screening purpose.

Remark 2. *If $\frac{p_s - p_r}{p_s} \leq p_s y_s - v - L$, then bank offers a pooling contract $\left(\frac{p_s y_s - v}{p_s}, 0 \right)$ to both safe and risky types.*

2.4 Competition between lenders without capacity constraint

In this section we introduce competition between the lenders. Further, we assume that none of the lenders are constrained by capacity(funds). Thus, each lender is capable of serving the

entire market of safe and risky borrowers.

Suppose bank offers a zero collateral contract $(\frac{p_s y_s - v}{p_s}, 0)$ to both safe and risky. This is not a Nash equilibrium contract because when both the lenders offer the same contract with zero collateral $(\frac{p_s y_s - v}{p_s}, 0)$ to both types of borrowers, then by our assumption, all will go to bank and moneylender earns zero profit. However, if the moneylender undercuts in repayment slightly by ϵ , both types of borrowers are going to take up moneylender's contract and it earns positive profits.

$$\pi^M(\frac{p_s y_s - v}{p_s}, 0) = 0$$

$$\begin{aligned} \pi^M(\frac{p_s y_s - v}{p_s} - \epsilon, 0) &= p_s(\frac{p_s y_s - v}{p_s} - \epsilon) + p_r(\frac{p_s y_s - v}{p_s} - \epsilon) - 2L \\ &= p_s y_s - v + \frac{p_r}{p_s}(p_s y_s - v) - 2L - \epsilon(p_s + p_r) > 0 \end{aligned}$$

Thus, we rule out $(\frac{p_s y_s - v}{p_s}, 0)$ as a Nash equilibrium contract for the lenders.

Suppose the bank offers a contract with positive collateral to both types of borrowers, while the moneylender gives a zero collateral contract $(\frac{p_s y_s - v}{p_s}, 0)$ to the safe and $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky. In that case only those borrowers with wealth less than C_i^B will go to moneylender, since they cannot afford collateral set by bank. If the lenders do not compete, their respective profits are:

$$\pi_i^B(R_i^B, C_i^B) = [p_i R_i^B + (1 - p_i)C_i^B - L](1 - C_i^B) \dots (4)$$

$$\pi_i^M(R_i^M, 0) = [p_i R_i^M - L]C_i^B \dots (5)$$

If the moneylender lowers repayment slightly by ϵ_i while the bank does not compete, it gets the entire market for safe and risky types and the profits are,

$$\pi_i^M(R_i^M - \epsilon_i, 0) = [p_i(R_i^M - \epsilon_i) - L] \dots (6)$$

From (5) and (6), the moneylender is indifferent between competing and not competing only if,

$$\begin{aligned} [p_i(R_i^M - \epsilon_i) - L] &= [p_i R_i^M - L]C_i^B \\ \Rightarrow \frac{[p_i R_i^M - L](1 - C_i^B)}{p_i} &= \epsilon_i, i = r, s \dots (7), \text{ which is true for a small } \epsilon_i. \end{aligned}$$

The bank must compete when the moneylender undercuts, otherwise it gets no borrowers. It is just sufficient for the bank to reduce repayment amount by the expression given above. The profits of the bank from reducing repayment are,

$$\begin{aligned} \pi_i^B(R_i^B - \epsilon_i, C_i^B) &= [p_i(R_i^B - \epsilon_i) + (1 - p_i)C_i^B - L](1 - C_i^B) \\ &= [p_i R_i^B + (1 - p_i)C_i^B - p_i \epsilon_i - L](1 - C_i^B) \dots (8a) \end{aligned}$$

Surplus to a borrower of type i from a lower repayment is,

$$U_i^M(R_i^M - \epsilon_i, 0) - U_i^M(R_i^M, 0) = v + p_i \epsilon_i - v = p_i \epsilon_i > 0 \dots (8b)$$

However, the bank may choose to undercut in collateral rather than in repayment. Profits to the bank from reducing collateral by say ϵ_i^c are,

$$\pi_i^B(R_i^B, C_i^B - \epsilon_i^c) = [p_i R_i^B + (1 - p_i)C_i^B - (1 - p_i)\epsilon_i^c - L](1 - C_i^B + \epsilon_i^c) \dots (9a)$$

Surplus to a type i borrower from the reduced collateral is given by,

$$U_i^B(R_i^B, C_i^B - \epsilon_i^c) - U_i^B(R_i^B, C_i^B) = (1 - p_i)\epsilon_i^c + v - v = (1 - p_i)\epsilon_i^c \dots (9b)$$

We compare the bank profits given by (8a) and (9a). The borrowers must get the same utility from these two contracts. Equating (8b) and (9b) gives the amount of reduction in collateral corresponding to a reduction in repayment which makes a borrower equally well-off. We have,

$$p_i \epsilon_i = (1 - p_i)\epsilon_i^c \Rightarrow \epsilon_i^c = \frac{p_i}{1-p_i} \epsilon_i \dots (10).$$

Using this in (9a) we get,

$$\begin{aligned} \pi_i^B(R_i^B, C_i^B - \frac{p_i}{1-p_i} \epsilon_i) &= [p_i R_i^B + (1 - p_i) C_i^B - (1 - p_i) \frac{p_i}{1-p_i} \epsilon_i - L](1 - C_i^B + \epsilon_i^c) \\ &= [p_i R_i^B + (1 - p_i) C_i^B - p_i \epsilon_i - L](1 - C_i^B + \epsilon_i^c) \end{aligned}$$

Clearly, (9a) denotes greater profits to the bank than (8a). This is due to an increased market share to bank from the reduced collateral. Using (7), we get the value of reduction in collateral as follows,

$$\epsilon_i^c = \frac{[p_i R_i^M - L](1 - C_i^B)}{1 - p_i}, i = r, s \dots (11).$$

The lower collateral offered by the bank to safe and risky types must be non-negative, i.e., $C_s^B - \epsilon_s^c \geq 0$ and $C_r^B - \epsilon_r^c \geq 0$. Plugging in the values of ϵ_i^c from (11) we obtain the lower bounds for C_i^B . These (collaterals) denote the minimum market shares to the moneylender so that it has no tendency to deviate from the initial contract. We get the following lower bounds:

$$C_s^B \geq \frac{(\frac{p_s R_s^M - L}{1 - p_s})}{1 + (\frac{p_s R_s^M - L}{1 - p_s})} \Rightarrow C_s^B \geq \frac{(\frac{p_s y_s - v - L}{1 - p_s})}{1 + (\frac{p_s y_s - v - L}{1 - p_s})} \dots (12)$$

$$C_r^B \geq \frac{(\frac{p_r R_r^M - L}{1 - p_r})}{1 + (\frac{p_r R_r^M - L}{1 - p_r})} \Rightarrow C_r^B \geq \frac{(\frac{p_r y_r - v - L}{1 - p_r})}{1 + (\frac{p_r y_r - v - L}{1 - p_r})} \dots (13)$$

Since $p_i y_i - v - L > 0$ and $1 - p_i > 0$, therefore, $0 < \frac{(\frac{p_i y_i - v - L}{1 - p_i})}{1 + (\frac{p_i y_i - v - L}{1 - p_i})} < 1$. This ensures that $C_i^B > 0$. The bank sets $C_s^B = \frac{p_s y_s - v - L}{(1 - p_s) + p_s y_s - v - L}$ for the safe and $C_r^B = \frac{p_r y_r - v - L}{(1 - p_r) + p_r y_r - v - L}$ for the risky to make the moneylender just indifferent. The corresponding repayments are obtained from the borrowers' participation constraints.

$$R_s^B = \frac{p_s y_s - v}{p_s} - \frac{(1 - p_s)(p_s y_s - v - L)}{p_s[(1 - p_s) + p_s y_s - v - L]} \dots (14)$$

$$R_r^B = \frac{p_r y_r - v}{p_r} - \frac{(1 - p_r)(p_r y_r - v - L)}{p_r[(1 - p_r) + p_r y_r - v - L]} \dots (15)$$

Thus, when the bank offers the contracts (R_i^B, C_i^B) given by (12)-(15) where $i = r, s$, the best response strategy of the moneylender is to not compete. The optimal contract of the moneylender for safe and risky types are given by $(\frac{p_s y_s - v}{p_s}, 0)$ and $(\frac{p_r y_r - v}{p_r}, 0)$ respectively.

Next we need to check if (R_i^B, C_i^B) constitutes the bank's optimal contract when the moneylender is offering $(\frac{p_s y_s - v}{p_s}, 0)$ and $(\frac{p_r y_r - v}{p_r}, 0)$ to safe and risky borrowers. We consider the isoprofit curves of bank in figure 3 in order to locate the contracts for safe and risky types. The bank's profit function from a type i borrower is,

$$\begin{aligned}\pi_i^B(R_i^B, C_i^B) &= [p_i R_i^B + (1 - p_i)C_i^B - L](1 - C_i^B) \\ &= p_i R_i^B(1 - C_i^B) + (1 - p_i)C_i^B(1 - C_i^B) - L(1 - C_i^B) \dots (16)\end{aligned}$$

We get the slope of the isoprofit curve of the bank as follows:

$$\frac{dC_i^B}{dR_i^B} = -\frac{p_i(1-C_i^B)}{L-p_iR_i^B+(1-p_i)(1-2C_i^B)} \dots (17)$$

From (16), we can see that the bank profit is certainly increasing in repayment, keeping collateral fixed. But the same cannot be said about collateral because increase in collateral is accompanied by a reduced market share. From (17), the slope of the curve is always positive (upward rising curve) for $C_i^B \geq \frac{1}{2}$. The slope of the isoprofit curve is negative when $C_i^B < \frac{1}{2}$ and $(1 - p_i)(1 - 2C_i^B) + L > p_i R_i^B$. We have $(1 - p_i)(1 - 2C_i^B) + L > p_i R_i^B$ since $L - p_i R_i^B \leq 0$. We show that bank profits are increasing as the isoprofit curves shift rightward. Suppose $C_s^B > \bar{C}$ where $(\bar{R}, \bar{C})$ is the common contract obtained by solving the two participation constraints. This lies to the right of (R_s^B, C_s^B) . We compare bank profits from safe clients at (R_s^B, C_s^B) and $(\bar{R}, \bar{C})$ and we have,

$$\pi_s^B(R_s^B, C_s^B) = [p_s y_s - v - L](1 - C_s^B) \dots (18)$$

$$\pi_s^B(\bar{R}, \bar{C}) = [p_s y_s - v - L](1 - \bar{C}) \dots (19)$$

We have $C_s^B > \bar{C}$, so $1 - C_s^B < 1 - \bar{C}$, and thus profits from $(\bar{R}, \bar{C})$ are greater.

Similarly, for risky, assuming $C_r^B < \bar{C}$, the profits from (R_r^B, C_r^B) will be greater than from $(\bar{R}, \bar{C})$. This shows that bank profits are increasing towards right.

For (R_i^B, C_i^B) (as derived from the moneylender's condition) to be profit maximizing for the bank, these must satisfy the participation constraints and incentive compatibility constraints of the borrowers. That is, the safe type's contract must lie at the intersection point $(\bar{R}, \bar{C})$ and risky type's contract must lie below this point. Therefore, we must have, $\bar{C} = C_s^B$ and $\bar{C} > C_r^B$.

Using (12) and (13) we have,

$$\begin{aligned}C_s^B &= \bar{C} \\ \Rightarrow \frac{p_s y_s - v - L}{(p_s y_s - v - L) + (1 - p_s)} &= \bar{C} \dots (20).\end{aligned}$$

$$\text{We have } \bar{C} > C_r^B = \frac{p_r y_r - v - L}{(p_r y_r - v - L) + (1 - p_r)} \dots (21)$$

Combining (20) and (21), we must have the following:

$$\begin{aligned}\frac{p_s y_s - v - L}{(p_s y_s - v - L) + (1 - p_s)} &> \frac{p_r y_r - v - L}{(p_r y_r - v - L) + (1 - p_r)} \\ \Rightarrow p_r y_r - p_s y_s &< p_s p_r (y_r - y_s) - (v + L)(p_s - p_r) \dots (22)\end{aligned}$$

The condition (22) ensures that (R_i^B, C_i^B) , $i = r, s$ are the optimal strategies of the bank when the contract of the moneylender is $(\frac{p_s y_s - v}{p_s}, 0)$ for safe and $(\frac{p_r y_r - v}{p_r}, 0)$ for risky borrowers. It is obvious that condition (22) implies assumption 3 in Section 2.2 which is given as condition (23).

$$p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r) \dots (23)$$

We get that whenever the difference between the expected returns from risky and safe projects is less than a threshold value, the lenders offer contracts such that utility level of the borrowers are at the opportunity cost. This condition is derived using the single-crossing property. We present the above result in the following proposition.

Proposition 2.4.1. *Given the set-up, If $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - (v + L)(p_s - p_r)$, then the contracts are such that the borrowers earn zero surplus. The optimal contracts are the following.*

a) *Moneylender: $(\frac{p_s y_s - v}{p_s}, 0)$ to the safe borrowers and $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky borrowers.*

b) *Bank: $(\frac{p_s y_s - v}{p_s} - \frac{(1-p_s)(p_s y_s - v - L)}{p_s[(1-p_s) + p_s y_s - v - L]}, \frac{p_s y_s - v - L}{(1-p_s) + p_s y_s - v - L})$ to the safe borrowers and $(\frac{p_r y_r - v}{p_r} - \frac{(1-p_r)(p_r y_r - v - L)}{p_r[(1-p_r) + p_r y_r - v - L]}, \frac{p_r y_r - v - L}{(1-p_r) + p_r y_r - v - L})$ to the risky borrowers.*

The bank sets a positive collateral for both types of borrowers and it is higher for the safe borrowers than for the risky borrowers. Thus, the bank rations the relatively poorer segment of both types of borrowers. Further, it rations more of the poor safe borrowers than the poor risky borrowers. The moneylender serves those borrowers (safe and risky) with wealth less than the collateral charged by the bank.

The next important thing to ask is whether we get a competitive outcome in this set-up. It is possible that condition (22) is violated and condition (23) is still true. In such situations we may get competitive outcome where both the lenders earn zero profits. Below we show the existence of competitive outcome in this set-up.

Suppose the moneylender offers a contract $(\frac{L}{p_s}, 0)$ to the safe borrowers and $(\frac{L}{p_r}, 0)$ to the risky borrowers (shown in figure 1). It is easy to see that the pay-off of the moneylender is zero at these contracts. The bank must offer such a contract so that the utility of the borrowers is similar to the utility they would obtain from the moneylender's contract. This implies that the optimal contract of the bank is to offer (L, L) to the safe borrowers and (L, L) to the risky borrowers. Note that the pay-off of the bank is also zero at this contract. Thus, there exists an optimal contract such that the pay-offs to the bank and the moneylender are zero. This is the competitive outcome in this set-up and it is similar to Bertrand paradox. We arrive at this solution irrespective of the condition (22) being satisfied. Thus, it follows that under certain conditions there are multiple Nash equilibria contracts in this set-up.

2.5 Competition between the lenders with moneylender having capacity constraint

Here we assume that the moneylender is constrained by capacity and let the available capacity be fixed at M , and $0 < M < 1$. This indicates that its capacity is not sufficient to serve either the safe or the risky segment entirely. The optimal contracts might differ from those in the previous case as the bank is aware of the moneylender's limited capacity.

Suppose the bank offers $(\frac{p_r y_r - v}{p_r}, 0)$ to risky and $(\bar{R}, \bar{C})$ to safe. Then, all risky borrowers take up the bank's contract if the moneylender offers the same contract to the risky. Of the safe types, the poorer $\bar{C}$ segment is left to the moneylender. Hence, moneylender must undercut in repayment to serve the risky. Note that the bank cannot give a zero collateral contract to safe types, due to incentive compatibility constraint. Given the moneylender's limited capacity, two possible situations arise. First, moneylender's capacity is small so that it may be profitable to cater to the residual market(the poorer safe) which is not served by the bank⁶. This is the case when $M \leq \bar{C}$. Second, when $M > \bar{C}$, the capacity is greater than a threshold $\bar{C}$ but not sufficient to serve all the safe borrowers. In this case there is a possibility that the moneylender competes with the bank for serving M safe borrowers, because it is venturing into the bank's safe market. We obtain the equilibrium strategies in each of these cases below.

5.1. $M \leq \bar{C}$

In this case, the moneylender may either target the residual safe segment $\bar{C}$ or target M risky. If it chooses the first option, there is no need to compete. However, it must undercut in repayment to serve the risky with its available funds. The profits in the two cases are given below.

$$\pi_s^M = (p_s y_s - v - L)M \dots (24)$$

$\pi_r^M = (p_r R_r^{M'} - L)M \dots (25)$, where $R_r^{M'}$ is the lower repayment which the moneylender must charge to the risky borrowers. The value of $R_r^{M'}$ that makes the moneylender indifferent between the two options is obtained as follows,

$$(p_s y_s - v - L)M = (p_r R_r^{M'} - L)M$$

⁶In our model, we use the term residual market in the following sense. When moneylender is serving a residual market, it is due to the outcome that bank charges a positive collateral from the safe, leaving out those borrowers with wealth below this collateral to be served by the moneylender. On the other hand, bank serves a residual segment whenever the moneylender has capacity constraint and thus cannot serve all, leaving this segment to be served by the bank.

$$\Rightarrow R_r^{M'} = \frac{p_s y_s - v}{p_r} \dots (26)$$

If the moneylender competes for M risky, then the bank is left with two options: not compete and serve the remaining $(1 - M)$ risky segment, or compete and serve all risky. The bank profits from no competition and from competition respectively are,

$$\pi_r^B = (p_r y_r - v - L)(1 - M) \dots (27)$$

$$\pi_r^B = (p_r R_r^{B'} - L) \dots (28)$$

Here $R_r^{B'}$ is the lower repayment such that bank is indifferent between the two options. Thus, we have,

$$(p_r y_r - v - L)(1 - M) = (p_r R_r^{B'} - L)$$

$$\Rightarrow R_r^{B'} = \frac{(p_r y_r - v - L)(1 - M) + L}{p_r} \dots (29)$$

We compare $R_r^{M'}$ and $R_r^{B'}$ to find out which one of the lenders has greater tendency to compete.

For instance if $R_r^{B'} > R_r^{M'}$ then the moneylender has a tendency to undercut below $R_r^{B'}$, so that bank will not find it profitable to compete. We derive below the conditions under which $R_r^{M'} > R_r^{B'}$ or $R_r^{M'} < R_r^{B'}$. Suppose, $R_r^{M'} < R_r^{B'}$, then,

$$\frac{p_s y_s - v}{p_r} < \frac{(p_r y_r - v - L)[1 - M] + L}{p_r}$$

$$\Rightarrow M < 1 - \left(\frac{p_s y_s - v - L}{p_r y_r - v - L} \right)$$

Since $M \leq \bar{C}$, the above will be true if,

$$\bar{C} < 1 - \left(\frac{p_s y_s - v - L}{p_r y_r - v - L} \right)$$

$$\Rightarrow \frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v < 1 - \left(\frac{p_s y_s - v - L}{p_r y_r - v - L} \right) \text{ (Plugging in } \bar{C} = \frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \text{)}$$

$$\Rightarrow p_r y_r - p_s y_s > \left[\frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \right] \times (p_r y_r - v - L) \dots (30)$$

From the assumption 3 in Section 2.2 we get the condition (23) that is $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r)$. So conditions (30) and (23) need to be satisfied together and we must have,

$$\left[\frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \right] \times (p_r y_r - v - L) < p_s p_r (y_r - y_s) - v(p_s - p_r)$$

$$\Rightarrow \left[\frac{p_s p_r (y_r - y_s) - v(p_s - p_r)}{p_s - p_r} \right] \times (p_r y_r - v - L) < p_s p_r (y_r - y_s) - v(p_s - p_r)$$

$$\Rightarrow p_s - p_r > p_r y_r - v - L \dots (31)$$

Thus, when the condition $p_s - p_r > p_r y_r - v - L$ is true and $M \leq \bar{C}$, the difference between the expected returns from risky and safe borrowers is greater than some threshold level, given by R.H.S. of (30). The optimal strategy of the moneylender is to compete for M risky to exhaust its available capacity at the contract $\left(\frac{(p_r y_r - v - L)(1 - M) + L}{p_r}, 0 \right)$. The bank serves the residual risky segment $(1 - M)$ not served by the moneylender. The wealthier segment of the safe borrowers $(1 - \bar{C})$ are served by the bank and the repayment is such that it extracts all surplus from the borrowers. However, the poorer segment of safe borrowers $\bar{C}$ are rationed from the credit market.

Now, we introduce a third possibility such that moneylender may choose to serve αM safe and $(1 - \alpha)M$ risky to exhaust its available capacity, where $\alpha \in [0, 1]$. Since $\alpha M \leq \bar{C}$, there is no competition for the safe and moneylender can give the contract $(\frac{p_s y_s - v}{p_s}, 0)$ to the safe extracting all their surplus. However, the moneylender must compete for the risky segment. We denote by $R_r^{M^0}$ the lower repayment that moneylender must offer the risky. The total profits to the moneylender in this case are,

$$\pi_{(\alpha M, (1-\alpha)M)}^M = (p_s y_s - v - L)\alpha M + (p_r R_r^{M^0} - L)(1 - \alpha)M \dots (32)^7$$

Since $M \leq \bar{C}$, $\alpha M \leq \bar{C}$ and there is no competition with respect to the safe types. Bank has two options to choose from. It may serve the residual risky segment $[1 - (1 - \alpha)M]$ at the highest repayment or it can capture the entire risky market by undercutting the repayment slightly. Let $R_r^{B^0}$ be the lower repayment that makes the bank indifferent between these two options. We thus have,

$$(p_r y_r - v - L)[1 - (1 - \alpha)M] = (p_r R_r^{B^0} - L)$$

$$\Rightarrow R_r^{B^0} = \frac{(p_r y_r - v - L)[1 - (1 - \alpha)M] + L}{p_r}$$

Moneylender must offer this repayment to the risky to serve $(1 - \alpha)M$ fraction of the risky. The profits to the moneylender evaluated at this contract $(\frac{(p_r y_r - v - L)[1 - (1 - \alpha)M] + L}{p_r}, 0)$ are,

$$\pi_{(\alpha M, (1-\alpha)M)}^M = (p_s y_s - v - L)\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \dots (33)$$

We now compare moneylender's profit when it serves all M risky with the profit from serving a combination that is αM safe and $(1 - \alpha)M$ risky. The profits from serving M risky is obtained when moneylender offers bank's indifference repayment rate given by (29) above. Suppose,

$$\begin{aligned} \pi_{(0, M)}^M &> \pi_{(\alpha M, (1-\alpha)M)}^M \\ \Rightarrow (p_r y_r - v - L)[1 - M]M &> (p_s y_s - v - L)\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \\ \Rightarrow (p_r y_r - v - L)[(1 - M) - (1 - (1 - \alpha)M)(1 - \alpha)] &> (p_s y_s - v - L)\alpha \\ \Rightarrow (p_r y_r - v - L)[\alpha - 2\alpha M + \alpha^2 M] &> (p_s y_s - v - L)\alpha \\ \Rightarrow 1 - 2M + \alpha M &> \frac{p_s y_s - v - L}{p_r y_r - v - L} \\ \Rightarrow 1 - \frac{p_s y_s - v - L}{p_r y_r - v - L} &> M(2 - \alpha) \\ \Rightarrow M < (\frac{1}{2 - \alpha}) * \frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \dots (34) \end{aligned}$$

Since $M \leq \bar{C}$, the above holds if $\bar{C} < (\frac{1}{2 - \alpha}) * \frac{p_r y_r - p_s y_s}{p_r y_r - v - L}$

$$\begin{aligned} \Rightarrow [\frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v] &< (\frac{1}{2 - \alpha}) * \frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \text{ (Plugging in } \bar{C} = \frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v) \\ \Rightarrow p_r y_r - p_s y_s &> (2 - \alpha)(p_r y_r - v - L) * [\frac{p_s p_r (y_r - y_s - v(p_s - p_r))}{p_s - p_r}] \dots (35) \end{aligned}$$

From the assumption 3 in Section 2.2 we get $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r)$ (condition

⁷Henceforth, the vector in the subscript of the profit function shall denote the market share to a lender such that the first element refers to the market for the safe types and the second element refers to the market for the risky types. This gives the aggregate profit to the lender from serving both types of borrowers.

23). So conditions (35) and (23) need to be satisfied together implying,

$$\begin{aligned} (2 - \alpha)(p_r y_r - v - L) * \left[\frac{p_s p_r (y_r - y_s - v(p_s - p_r))}{p_s - p_r} \right] &< p_s p_r (y_r - y_s) - v(p_s - p_r) \\ \Rightarrow (2 - \alpha)(p_r y_r - v - L) &< p_s - p_r \\ \Rightarrow p_s - p_r &> (2 - \alpha)(p_r y_r - v - L) \dots (36) \end{aligned}$$

When $p_s - p_r > 2(p_r y_r - v - L)$ then (36) is always true $\forall \alpha \in [0, 1]$. The interpretation of this condition is that if the difference between the expected returns from the risky and safe projects is greater than some threshold level given by the R.H.S. of (35), moneylender obtains higher profits by serving M risky borrowers to exhaust its available capacity. The bank on the other hand is better off serving the relatively wealthier segment of safe borrowers $(1 - \bar{C})$ and the residual risky segment $(1 - M)$ risky not served by the moneylender due to its limited capacity. There is rationing of the poorer segment of the safe borrowers $\bar{C}$. The single crossing property is satisfied in this case. We collect the above results in the following proposition.

Proposition 2.5.1. *Given the set-up, the optimal contract of the moneylender is to serve M risky borrowers by offering the contract $(\frac{(p_r y_r - v - L)(1 - M) + L}{p_r}, 0)$ to the risky and the optimal contract of the bank is to offer $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky and $([\frac{p_s y_s (1 - p_r) - p_r y_r (1 - p_s)}{p_s - p_r}] - v, [\frac{p_s p_r (y_r - y_s)}{p_s - p_r}] - v)$ to the safe if $p_s - p_r > 2(p_r y_r - v - L)$.*

When $M \leq \bar{C}$, the contract we get in proposition 2.5.1. is unique when the condition $p_s - p_r > 2(p_r y_r - v - L)$ is true. This is a unique Nash equilibrium outcome since bank serves the residual segment of borrowers and earns positive profits, and the moneylender maximizes its profits to exhaust the available capacity. This outcome rules out the possibility of a zero-profit contract on the part of both the bank and the moneylender.

Suppose $p_s - p_r > 2(p_r y_r - v - L)$ is not true. We want to check if an optimal α exists, $\alpha \in [0, 1]$ such that $p_s - p_r < (2 - \alpha)(p_r y_r - v - L)$.

From (33) we have,

$$\begin{aligned} \pi_{(\alpha M, (1 - \alpha)M)}^M &= (p_s y_s - v - L)\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \\ &= (p_s y_s - v - L)\alpha M + (p_r y_r - v - L)[(1 - \alpha)M - (1 - \alpha)^2 M^2] \dots (37) \end{aligned}$$

We maximize (37) w.r.t. α to obtain the optimal α and we get the following from the first order condition⁸,

$$2M(1 - \alpha) = 1 - \frac{p_s y_s - v - L}{p_r y_r - v - L}$$

⁸It is easy to check that the second order condition is satisfied.

$$\Rightarrow \alpha = 1 - \frac{1}{2M} * \left(\frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \right)$$

$$\text{We must have } 0 < 1 - \frac{1}{2M} * \left(\frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \right) < 1$$

$$\text{or, } \frac{1}{2M} * \left(\frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \right) < 1$$

$$\Rightarrow \frac{p_r y_r - p_s y_s}{p_r y_r - v - L} < 2M$$

Since $M \leq \bar{C}$, this is true if,

$$\frac{p_r y_r - p_s y_s}{p_r y_r - v - L} < 2\bar{C}$$

$$\Rightarrow \frac{p_r y_r - p_s y_s}{p_r y_r - v - L} < 2 * \left[\frac{p_s p_r (y_r - y_s) - v(p_s - p_r)}{p_s - p_r} \right] \text{ (plugging in the value of } \bar{C} \text{)}$$

$$\Rightarrow p_r y_r - p_s y_s < 2(p_r y_r - v - L) * \left[\frac{p_s p_r (y_r - y_s) - v(p_s - p_r)}{p_s - p_r} \right] \dots (38)$$

From our assumption, we know that $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r)$. Also, we have that $p_s - p_r < 2(p_r y_r - v - L) \Rightarrow \frac{2(p_r y_r - v - L)}{p_s - p_r} > 1$.

Thus, we get $\frac{2(p_r y_r - v - L)}{p_s - p_r} > 1$ as the condition which ensures that (38) is true. The interpretation of this condition is that if the difference between the expected returns from the risky and the safe projects is less than some threshold level given by the R.H.S. of (38), moneylender is better off serving a combination, that is, αM safe and $(1 - \alpha)M$ risky to exhaust its available capacity rather than targeting only the risky. The bank serves the residual market, that is, the relatively wealthier segment $(1 - \bar{C})$ of safe and $[1 - (1 - \alpha)M]$ of risky. Note that the single crossing property is required for this condition to be true. There is rationing of the poorer safe borrowers to the extent $(\bar{C} - \alpha M)$ since $\alpha M < \bar{C}$. Further, if condition (31) is satisfied, the moneylender prefers serving M risky than serving M safe. So, combining these two conditions we get the condition $2(p_r y_r - v - L) > p_s - p_r > p_r y_r - v - L$, which ensures that it is optimal for the moneylender to serve a combination of safe and risky than to serve either only safe or only risky. We collect this result in the following proposition.

Proposition 2.5.2. *Given the set-up, the optimal contract of the moneylender is to serve a fraction αM of safe and $(1 - \alpha)M$ fraction of risky, where $\alpha = 1 - \frac{1}{2M} * \left(\frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \right)$ by offering the contract $(\frac{p_s y_s - v}{p_s}, 0)$ to the safe and $(\frac{(p_r y_r - v - L)[1 - (1 - \alpha)M] + L}{p_r}, 0)$ to the risky and the optimal contract of the bank is to serve $(1 - \bar{C})$ safe and $[1 - (1 - \alpha)M]$ risky by offering the contract $([\frac{p_s y_s (1 - p_r) - p_r y_r (1 - p_s)}{p_s - p_r}] - v, [\frac{p_s p_r (y_r - y_s)}{p_s - p_r}] - v)$ to the safe and $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky if $2(p_r y_r - v - L) > p_s - p_r > p_r y_r - v - L$.*

The contract we get in proposition 2.5.2. is a unique Nash equilibrium outcome in the case $M \leq \bar{C}$ when the condition $2(p_r y_r - v - L) > p_s - p_r > p_r y_r - v - L$ is satisfied. This is because the bank serves the residual market of safe and risky borrowers maximizing its profits and the

moneylender exhausts its available capacity. Further, this outcome rules out the possibility of a zero-profit contract on the part of both the bank and the moneylender.

5.2. $M > \bar{C}$

In this case, the moneylender's available capacity exceeds the residual safe segment not served by the bank. Therefore, the moneylender must involve in competition with the bank if it is to serve M safe borrowers with its available capacity. The moneylender has two options to choose from: compete for M risky, or serve a mix of both types, that is, αM safe and $(1 - \alpha)M$ risky, $\alpha \in [0, 1]$. When $\alpha = 1$, it implies that only safe are being served.

Consider the first scenario where the moneylender targets M risky. Denote by $R_r^{M'}$ the lowest repayment that the moneylender must charge from the risky. The profits are,

$$\pi_r^M = (p_r R_r^{M'} - L)M \dots (39)$$

Corresponding to the above strategy of the moneylender, the bank gets to serve the residual $(1 - M)$ risky segment if it does not compete, while by undercutting in repayment slightly the bank gets the entire market for risky borrowers. The profits in the two alternate situations are as follows:

$$\pi_r^B = (p_r y_r - v - L)(1 - M) \dots (40)$$

$$\pi_r^B = (p_r R_r^{B'} - L) \dots (41)$$

Here $R_r^{B'}$ is the lowest possible repayment at which the bank is indifferent between competing and not competing. Thus we have,

$$(p_r y_r - v - L)(1 - M) = (p_r R_r^{B'} - L) \\ \Rightarrow R_r^{B'} = \frac{(p_r y_r - v - L)(1 - M) + L}{p_r} \dots (42)$$

Since the moneylender must undercut to serve M risky, it is just sufficient to set $R_r^{M'} = R_r^{B'}$. This will ensure that the bank will not compete, since indifferent. Then the profits to the moneylender evaluated at $(R_r^{B'}, 0)$ are,

$$\pi_r^M = (p_r R_r^{B'} - L)M = (p_r y_r - v - L)(1 - M)M \dots (43)$$

We now consider another possibility where the moneylender serves $\bar{C}$ safe and divert the remaining capacity $(M - \bar{C})$ towards the risky. This is a specific case of the mixed configuration αM safe and $(1 - \alpha)M$ risky. There is no competition with respect to the safe borrowers since $\alpha M \leq \bar{C}$. The moneylender can offer $(\frac{p_s y_s - v}{p_s}, 0)$ to the safe. However, the moneylender must undercut to serve the risky. Denote by $R_r^{M''}$ the lower repayment which the moneylender must charge from the risky. The profits to the moneylender in this case are,

$$\pi_r^M = (p_r R_r^{M''} - L)(M - \bar{C}) + (p_s y_s - v - L)\bar{C} \dots (44)$$

As before, the bank has two possible strategies: compete and not compete. By competing, it gets the entire risky market, and if chooses not to compete, it must serve the residual segment, i.e., $(1 - M + \bar{C})$. The respective profits are,

$$\pi_r^B = (p_r y_r - v - L)(1 - M + \bar{C}) \dots (45)$$

$$\pi_r^B = p_r R_r^{B''} - L \dots (46)$$

Here $R_r^{B''}$ is the lowest repayment which makes the bank indifferent between the two options.

We thus have,

$$(p_r y_r - v - L)(1 - M + \bar{C}) = p_r R_r^{B''} - L \\ \Rightarrow R_r^{B''} = \frac{(p_r y_r - v - L)(1 - M + \bar{C}) + L}{p_r} \dots (47)$$

Given this, it is just sufficient for the moneylender to set $R_r^{M''} = R_r^{B''}$ in order to serve $(M - \bar{C})$ risky. The profits to moneylender evaluated at $(R_r^{B''}, 0)$ are given below.

$$\pi_r^M = (p_r y_r - v - L)(1 - M + \bar{C})(M - \bar{C}) + (p_s y_s - v - L)\bar{C} \dots (48)$$

We compare the profits to the moneylender given by (43) and (48). Suppose $(43) < (48)$. Then we have,

$$(p_r y_r - v - L)(1 - M)M < (p_r y_r - v - L)(1 - M + \bar{C})(M - \bar{C}) + (p_s y_s - v - L)\bar{C} \\ \Rightarrow 1 - 2M + \bar{C} < \frac{p_s y_s - v - L}{p_r y_r - v - L} \\ \Rightarrow M > \frac{1 - (\frac{p_s y_s - v - L}{p_r y_r - v - L}) + \bar{C}}{2} \dots (49)$$

This is true if the R.H.S. of (49) is less than or equal to $\bar{C}$, given $M > \bar{C}$. That is,

$$\bar{C} \geq \frac{1 - (\frac{p_s y_s - v - L}{p_r y_r - v - L}) + \bar{C}}{2} \\ \Rightarrow \bar{C} \geq 1 - \left(\frac{p_s y_s - v - L}{p_r y_r - v - L} \right) \\ \Rightarrow \frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \geq \frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \\ \Rightarrow p_r y_r - p_s y_s \leq \left[\frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \right] \times (p_r y_r - v - L) \dots (50)$$

From the assumption 3 we have $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r)$, condition (23). So conditions (23) and (50) need to be satisfied together and we must have,

$$\left[\frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \right] \times (p_r y_r - v - L) \geq p_s p_r (y_r - y_s) - v(p_s - p_r) \\ \Rightarrow p_s - p_r \leq p_r y_r - v - L \dots (51)$$

Thus if $M > \bar{C}$ and (51) is true then serving the combination $\bar{C}$ safe and $(M - \bar{C})$ risky gives higher profits to the moneylender than serving M risky borrowers. The bank serves the residual and relatively wealthier safe segment $(1 - \bar{C})$ and $(1 - M + \bar{C})$ risky. Note that the single crossing property is used to derive the condition (51).

We also consider other mixed configurations such as αM safe and $(1 - \alpha)M$ risky such that $\alpha M \neq \bar{C}$. We now look at the case where $\alpha M < \bar{C}$, $\alpha \in [0, 1]$. In this case, moneylender can

easily serve αM safe without involving in competition with the bank. The total profits to the moneylender from serving αM safe and $(1 - \alpha)M$ risky are given by (33) above.

$$\pi_{(\alpha M, (1-\alpha)M)}^M = (p_s y_s - v - L)\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M$$

We compare this with the profits obtained by the moneylender from serving $\bar{C}$ safe and $(M - \bar{C})$ which is given by (48).

Suppose (48) > (33), then we have,

$$\begin{aligned} & (p_s y_s - v - L)\bar{C} + (p_r y_r - v - L)(1 - M + \bar{C})(M - \bar{C}) > (p_s y_s - v - L)\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \\ \Rightarrow & (p_s y_s - v - L)(\bar{C} - \alpha M) > (p_r y_r - v - L)[(1 - (1 - \alpha)M)(1 - \alpha)M - (1 - M + \bar{C})(M - \bar{C})] \\ \Rightarrow & (p_s y_s - v - L)(\bar{C} - \alpha M) > (p_r y_r - v - L)[\alpha M(2M - 1 - \alpha M) - \bar{C}(2M - 1 - \bar{C})] \\ \Rightarrow & \frac{p_s y_s - v - L}{p_r y_r - v - L} > \bar{C} + \alpha M - 2M + 1 \\ \Rightarrow & \frac{p_s y_s - v - L}{p_r y_r - v - L} > 1 + \bar{C} + M(\alpha - 2) \\ \Rightarrow & M(2 - \alpha) - \bar{C} > \frac{p_r y_r - p_s y_s}{p_r y_r - v - L} \\ \Rightarrow & p_r y_r - p_s y_s < [M(2 - \alpha) - \bar{C}](p_r y_r - v - L) \end{aligned}$$

From our assumption, we know that $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r)$. This is the single crossing property. So, we must have,

$$\begin{aligned} \Rightarrow & p_s p_r (y_r - y_s) - v(p_s - p_r) < [M(2 - \alpha) - \bar{C}](p_r y_r - v - L) \\ \Rightarrow & [M(2 - \alpha)](p_r y_r - v - L) > [p_s p_r (y_r - y_s) - v(p_s - p_r)] + \bar{C}(p_r y_r - v - L) \\ \Rightarrow & [M(2 - \alpha)](p_r y_r - v - L) > [p_s p_r (y_r - y_s) - v(p_s - p_r)] + \frac{p_s p_r (y_r - y_s) - v(p_s - p_r)}{p_s - p_r} (p_r y_r - v - L) \\ \Rightarrow & M(2 - \alpha) > \bar{C} \left[1 + \frac{p_s - p_r}{p_r y_r - v - L} \right] \end{aligned}$$

After rearranging terms, we get,

$$\frac{(2M - \bar{C})(p_r y_r - v - L) - \bar{C}(p_s - p_r)}{M(p_r y_r - v - L)} > \alpha$$

$$\Rightarrow \left(2 - \frac{\bar{C}}{M} \right) - \frac{\bar{C}}{M} \left(\frac{p_s - p_r}{p_r y_r - v - L} \right) > \alpha$$

Since $M > \bar{C}$, the above is true if $\left(2 - \frac{\bar{C}}{M} \right) > \frac{p_s - p_r}{p_r y_r - v - L}$ and this is true when we have $1 > \frac{p_s - p_r}{p_r y_r - v - L}$

$$\Rightarrow p_s - p_r < p_r y_r - v - L \dots (52)$$

In the case when $M > \bar{C}$, and $\alpha M < \bar{C}$ and if (52) holds, then moneylender is better off serving $\bar{C}$ safe and $(M - \bar{C})$ risky than serving αM safe and $(1 - \alpha)M$ risky.

Now we consider the case where $\alpha M > \bar{C}$, $\alpha \in [0, 1]$. The profits from the risky are same as in the previous case. However, for the safe, the moneylender must lower the repayment by a small amount ϵ_m such that the new repayment is $\left(\frac{p_s y_s - v}{p_s} - \epsilon_m \right)$. Bank may either serve the residual safe segment $(1 - \alpha M)$ or may compete by undercutting slightly in repayment by ϵ_b so

that it can serve $(1 - \bar{C})$ safe. We compare the profits in these two situations to derive bank's indifference point. If bank does not undercut, the profits are,

$$\begin{aligned} \pi_s^B(\bar{R}, \bar{C}), \text{ where } (\bar{R}, \bar{C}) &= \left(\frac{p_s y_s (1-p_r) - p_r y_r (1-p_s)}{p_s - p_r} - v, \frac{p_s p_r (y_r - y_s)}{p_s - p_r} - v \right) \\ &= [p_s \bar{R} + (1 - p_s) \bar{C}] - L(1 - \alpha M) \\ &= (p_s y_s - v - L)[1 - \alpha M] \dots (53) \end{aligned}$$

If the bank lowers the repayment by ϵ_b , the profits are,

$$\begin{aligned} \pi_s^B(\bar{R} - \epsilon_b, \bar{C}) \\ &= [p_s(\bar{R} - \epsilon_b) + (1 - p_s)\bar{C} - L](1 - \bar{C}) \\ &= [p_s \bar{R} + (1 - p_s)\bar{C} - p_s \epsilon_b - L](1 - \bar{C}) \\ &= (p_s y_s - v - L - p_s \epsilon_b)[1 - \bar{C}] \dots (54) \end{aligned}$$

Equating (53) and (54) we get the value of ϵ_b that makes the bank indifferent between the two options.

$$\begin{aligned} (p_s y_s - v - L)[1 - \alpha M] &= (p_s y_s - v - L - p_s \epsilon_b)[1 - \bar{C}] \\ \Rightarrow (p_s y_s - v - L)[1 - \alpha M] &= (p_s y_s - v - L)[1 - \bar{C}] - p_s \epsilon_b[1 - \bar{C}] \\ \Rightarrow (p_s y_s - v - L)[1 - \bar{C} - (1 - \alpha M)] &= p_s \epsilon_b(1 - \bar{C}) \\ \Rightarrow (p_s y_s - v - L)[\alpha M - \bar{C}] &= p_s \epsilon_b(1 - \bar{C}) \\ \Rightarrow \epsilon_b &= \frac{(p_s y_s - v - L)[\alpha M - \bar{C}]}{p_s(1 - \bar{C})} \dots (55) \end{aligned}$$

Moneylender must lower the repayment by the same amount, that is, $\epsilon_m = \epsilon_b$ so that bank has no tendency to compete. So, the contract offered to the safe borrowers is given by $(\frac{p_s y_s - v}{p_s} - \frac{(p_s y_s - v - L)[\alpha M - \bar{C}]}{p_s(1 - \bar{C})}, 0)$ and to the risky is given by $(\frac{(p_r y_r - v - L)[1 - (1 - \alpha)M + L]}{p_r}, 0)$. The total profits to the moneylender at this contract are given by,

$$\begin{aligned} \pi_{(\alpha M, (1 - \alpha)M)}^M &= [p_s(\frac{p_s y_s - v}{p_s} - \epsilon_m) - L]\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \\ &= [p_s(\frac{p_s y_s - v}{p_s} - \frac{(p_s y_s - v - L)(\alpha M - \bar{C})}{p_s(1 - \bar{C})}) - L]\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \\ &= [\frac{(p_s y_s - v - L)(1 - \alpha M)}{(1 - \bar{C})}]\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \dots (56) \end{aligned}$$

We compare this with the profits obtained by the moneylender from serving $\bar{C}$ safe and $(M - \bar{C})$ which is given by (48).

$$\pi_{(\bar{C}, (M - \bar{C}))}^M = (p_s y_s - v - L)\bar{C} + (p_r y_r - v - L)(1 - M + \bar{C})(M - \bar{C})$$

Suppose (48) > (56). Then we have,

$$\begin{aligned} (p_s y_s - v - L)\bar{C} + (p_r y_r - v - L)(1 - M + \bar{C})(M - \bar{C}) &> [\frac{(p_s y_s - v - L)(1 - \alpha M)}{(1 - \bar{C})}]\alpha M + (p_r y_r - v - L)[1 - (1 - \alpha)M](1 - \alpha)M \\ \Rightarrow (p_s y_s - v - L)[\bar{C} - \frac{\alpha M(1 - \alpha M)}{1 - \bar{C}}] &> (p_r y_r - v - L)[[1 - (1 - \alpha)M](1 - \alpha)M - (1 - M + \bar{C})(M - \bar{C})] \\ \Rightarrow (p_s y_s - v - L)[\frac{\bar{C}(1 - \bar{C}) - \alpha M(1 - \alpha M)}{1 - \bar{C}}] &> (p_r y_r - v - L)(\alpha M - \bar{C})[M(2 - \alpha) - 1 - \bar{C}] \end{aligned}$$

$$\begin{aligned} &\Rightarrow (p_s y_s - v - L) \left[\frac{(\alpha M + \bar{C} - 1)}{1 - \bar{C}} \right] > (p_r y_r - v - L) [M(2 - \alpha) - 1 - \bar{C}] \\ &\Rightarrow \frac{p_s y_s - v - L}{p_r y_r - v - L} > \frac{[M(2 - \alpha) - 1 - \bar{C}]}{\alpha M + \bar{C} - 1} (1 - \bar{C}) \dots (57) \end{aligned}$$

Here, $(1 - \bar{C}) > 0$ and $0 < \frac{p_s y_s - v - L}{p_r y_r - v - L} \leq 1$. We check whether $\frac{M(2 - \alpha) - 1 - \bar{C}}{\alpha M + \bar{C} - 1}$ is increasing in α when $\alpha \in [0, 1]$.

The derivative of $\frac{M(2 - \alpha) - 1 - \bar{C}}{\alpha M + \bar{C} - 1}$ with respect to α is,

$$\begin{aligned} &\frac{d \left[\frac{M(2 - \alpha) - 1 - \bar{C}}{\alpha M + \bar{C} - 1} \right]}{d\alpha} \\ &= \frac{[\alpha M + \bar{C} - 1](-M) - [M(2 - \alpha) - 1 - \bar{C}]M}{(\alpha M + \bar{C} - 1)^2} \\ &= -M \left[\frac{2M - 2}{(\alpha M + \bar{C} - 1)^2} \right] \\ &= \frac{2M(1 - M)}{(\alpha M + \bar{C} - 1)^2} > 0, \text{ since } (1 - M) > 0 \end{aligned}$$

We get that $\frac{M(2 - \alpha) - 1 - \bar{C}}{\alpha M + \bar{C} - 1}$ is increasing in α , $\alpha \in [0, 1]$. So, the maximum value it takes is $\frac{M - 1 - \bar{C}}{M + \bar{C} - 1} (1 - \bar{C})$. It is obvious that $(M - 1 - \bar{C}) < 0$.

If $M + \bar{C} > 1$, then $\frac{M - 1 - \bar{C}}{M + \bar{C} - 1} (1 - \bar{C}) < 0$. In such situation, $\frac{p_s y_s - v - L}{p_r y_r - v - L} > \frac{M - 1 - \bar{C}}{M + \bar{C} - 1} (1 - \bar{C})$ is always true. Note that the single crossing property is already satisfied in deriving condition (52). We collect this result in the following proposition.

Proposition 2.5.3. *Given the set-up, $M + \bar{C} > 1$ and $M > \bar{C}$, the optimal strategy of the moneylender is to serve $\bar{C}$ safe and $(M - \bar{C})$ risky by offering the contract $(\frac{p_s y_s - v}{p_s}, 0)$ to the safe and $(\frac{(p_r y_r - v - L)(1 - M + \bar{C}) + L}{p_r}, 0)$ to the risky, and the optimal strategy for the bank is to serve the residual safe $(1 - \bar{C})$ and the residual risky $(1 - M + \bar{C})$ by offering $([\frac{p_s y_s (1 - p_r) - p_r y_r (1 - p_s)}{p_s - p_r}] - v, [\frac{p_s p_r (y_r - y_s)}{p_s - p_r}] - v)$ to the safe and $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky, if $p_s - p_r < p_r y_r - v - L$.*

In the case $M > \bar{C}$, and $M + \bar{C} > 1$, the contract given in proposition 2.5.3. constitutes a unique Nash equilibrium outcome when $p_s - p_r < p_r y_r - v - L$ is true. The bank earns positive profits by serving the residual market not served by the moneylender and has no tendency to undercut. The moneylender is serving its full capacity and hence by lowering repayment further it cannot increase its profits. Also, since moneylender is offering a repayment to its clients such that bank is indifferent, it has no tendency to charge any higher repayment rate. As in the previous case, $M \leq \bar{C}$, this outcome rules out the possibility of a zero-profit contract on the part of both the bank and the moneylender.

Suppose $M + \bar{C} - 1 < 0$. In this situation, $\frac{p_s y_s - v - L}{p_r y_r - v - L} \not> \frac{M - 1 - \bar{C}}{M + \bar{C} - 1} (1 - \bar{C})$.

$$\begin{aligned} &\text{Since, } \frac{M + \bar{C} - 1}{(M - 1 - \bar{C})(1 - \bar{C})} > \frac{p_r y_r - v - L}{p_s y_s - v - L} \\ &\Rightarrow \frac{M + \bar{C} - 1}{(M - 1 - \bar{C})(1 - \bar{C})} - 1 > \frac{p_r y_r - p_s y_s}{p_s y_s - v - L} \end{aligned}$$

$$\begin{aligned} &\Rightarrow \frac{M+\bar{C}-1-(1-\bar{C})(M-1-\bar{C})}{(M-1-\bar{C})(1-\bar{C})} > \frac{p_r y_r - p_s y_s}{p_s y_s - v - L} \\ &\Rightarrow \frac{\bar{C}(M+1-\bar{C})}{(M-1-\bar{C})(1-\bar{C})} > \frac{p_r y_r - p_s y_s}{p_s y_s - v - L} \end{aligned}$$

Since $M - 1 - \bar{C} < 0$, the above is not true. Thus when $M + \bar{C} < 1$, $\frac{p_s y_s - v - L}{p_r y_r - v - L} < \frac{M-1-\bar{C}}{M+\bar{C}-1}(1-\bar{C})$, when $\alpha = 1$. This implies that (48) < (56). We have obtained (56) for arbitrary α , $\alpha \in [0, 1]$ and $M + \bar{C} \leq 1$. So we maximize (56) with respect to α to find the optimal α .

$$\begin{aligned} &\frac{d}{d\alpha} \left[\frac{(p_s y_s - v - L)(1-\alpha M)\alpha M}{(1-\bar{C})} + (p_r y_r - v - L)[1 - (1-\alpha)M](1-\alpha)M \right] \\ &= \frac{p_s y_s - v - L}{1-\bar{C}} [M - 2\alpha M^2] + (p_r y_r - v - L)[2M(1-\alpha) - 1]M \end{aligned}$$

We get the following first order condition⁹,

$$\begin{aligned} &\frac{p_s y_s - v - L}{1-\bar{C}} [1 - 2\alpha M] + (p_r y_r - v - L)[2M(1-\alpha) - 1] = 0 \\ &\Rightarrow \frac{p_s y_s - v - L}{1-\bar{C}} + (p_r y_r - v - L)[2M - 1] = 2\alpha M \left[\frac{p_s y_s - v - L}{1-\bar{C}} \right] + 2\alpha M [p_r y_r - v - L] \\ &\Rightarrow \alpha = \frac{\frac{p_s y_s - v - L}{1-\bar{C}} + (p_r y_r - v - L)[2M - 1]}{2M \left[\frac{p_s y_s - v - L}{1-\bar{C}} + (p_r y_r - v - L) \right]} = \frac{p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})[2M - 1]}{2M [p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})]} \end{aligned}$$

$$\text{If } 2M \geq 1, \text{ then, } 0 < \frac{p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})[2M - 1]}{2M [p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})]} < 1$$

The interpretation of this result is that in the case $M > \bar{C}$, when $M + \bar{C} \leq 1$ and $2M \geq 1$ are true, we get an optimal α provided $p_s - p_r < p_r y_r - v - L$. We collect this result in the following proposition.

Proposition 2.5.4. *Given the set-up, $2M \geq 1$, $M + \bar{C} \leq 1$, and $M > \bar{C}$, the optimal contract of the moneylender is to serve αM safe and $(1 - \alpha)M$ risky by offering the contract $(\left[\frac{(p_s y_s - v)(1-\bar{C}) - (p_s y_s - v - L)[\alpha M - \bar{C}]}{p_s(1-\bar{C})} \right], 0)$ to the safe and $(\frac{(p_r y_r - v - L)[1 - (1-\alpha)M] + L}{p_r}, 0)$ to the risky, and the bank serves the residual $(1 - \alpha M)$ safe and $[1 - (1 - \alpha)M]$ risky by offering the contract $(\left[\frac{p_s y_s(1-p_r) - p_r y_r(1-p_s)}{p_s - p_r} \right] - v, \left[\frac{p_s p_r(y_r - y_s)}{p_s - p_r} \right] - v)$ to the safe and $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky, where $\alpha = \frac{p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})[2M - 1]}{2M [p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})]}$, if $p_s - p_r < p_r y_r - v - L$.*

Note that condition (52) satisfies the single crossing property, hence this property is satisfied in this proposition.

When $2M < 1$ and $M + \bar{C} \leq 1$, we must have, $0 < \frac{p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})[2M - 1]}{2M [p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})]} < 1$. So we need $p_s y_s - v - L > (1 - 2M)(1 - \bar{C})(p_r y_r - v - L)$ for the above to be positive. That is,

$$\begin{aligned} &\frac{1}{(1-2M)(1-\bar{C})} > \frac{p_r y_r - v - L}{p_s y_s - v - L} \\ &\Rightarrow \frac{1}{(1-2M)(1-\bar{C})} - 1 > \frac{p_r y_r - p_s y_s}{p_s y_s - v - L} \\ &\Rightarrow p_r y_r - p_s y_s < \frac{2M(1-\bar{C})+\bar{C}}{(1-2M)(1-\bar{C})}(p_s y_s - v - L) \dots (58) \end{aligned}$$

⁹The second order condition is automatically satisfied.

From condition (23) we have $p_r y_r - p_s y_s < p_s p_r (y_r - y_s) - v(p_s - p_r)$. Hence,

$$\frac{2M(1-\bar{C})+\bar{C}}{(1-2M)(1-\bar{C})}(p_s y_s - v - L) > p_s p_r (y_r - y_s) - v(p_s - p_r) \text{ implies that the condition (58) is true.}$$

After simplification we get,

$$p_s - p_r > \frac{p_s p_r (y_r - y_s)}{v} - \frac{2M(1-\bar{C})+\bar{C}}{v(1-2M)(1-\bar{C})}(p_s y_s - v - L)$$

Again from condition (51) we have $p_s - p_r \leq p_r y_r - v - L$. So we need,

$$\begin{aligned} p_r y_r - v - L &> \frac{p_s p_r (y_r - y_s)}{v} - \frac{2M(1-\bar{C})+\bar{C}}{v(1-2M)(1-\bar{C})}(p_s y_s - v - L) \\ \Rightarrow p_s y_s - v - L &> \frac{(1-2M)(1-\bar{C})}{2M(1-\bar{C})+\bar{C}} * [p_s p_r (y_r - y_s) - v(p_r y_r - v - L)] \dots (59), \end{aligned}$$

this is one condition.

We also need,

$$\begin{aligned} &\frac{\frac{p_s y_s - v - L}{1-\bar{C}} + (p_r y_r - v - L)[2M-1]}{2M[\frac{p_s y_s - v - L}{1-\bar{C}} + (p_r y_r - v - L)]} < 1. \\ \Rightarrow \frac{p_s y_s - v - L}{1-\bar{C}} + 2M(p_r y_r - v - L) - (p_r y_r - v - L) &< 2M[\frac{p_s y_s - v - L}{1-\bar{C}}] + 2M(p_r y_r - v - L) \\ \Rightarrow \frac{p_s y_s - v - L}{1-\bar{C}} - 2M[\frac{p_s y_s - v - L}{1-\bar{C}}] &< p_r y_r - v - L \\ \Rightarrow p_s y_s - v - L &< \frac{(1-\bar{C})}{(1-2M)} * [p_r y_r - v - L] \dots (60) \end{aligned}$$

Using (59) and (60), we get the following condition,

$$\begin{aligned} &\frac{(1-\bar{C})}{(1-2M)} * [p_r y_r - v - L] > \frac{(1-2M)(1-\bar{C})}{2M(1-\bar{C})+\bar{C}} * [p_s p_r (y_r - y_s) - v(p_r y_r - v - L)] \\ \Rightarrow p_r y_r - v - L &> \frac{(1-2M)^2}{2M(1-\bar{C})+\bar{C}} * [p_s p_r (y_r - y_s) - v(p_r y_r - v - L)] \\ \Rightarrow (p_r y_r - v - L)[1 + \frac{v(1-2M)^2}{2M(1-\bar{C})+\bar{C}}] &> \frac{(1-2M)^2}{2M(1-\bar{C})+\bar{C}} * [p_s p_r (y_r - y_s)] \\ \Rightarrow p_r y_r - v - L &> \frac{p_s p_r (y_r - y_s)(1-2M)^2}{2M(1-\bar{C})+\bar{C}+v(1-2M)^2} \dots (61) \end{aligned}$$

The interpretation of this condition is that when the the expected return from a risky project net of the loan amount L and borrowers' opportunity cost v is greater than some threshold value given by the R.H.S. of (61), moneylender is better off serving αM safe and $(1 - \alpha)M$ risky while bank serves the residual $(1 - \alpha M)$ safe and $[1 - (1 - \alpha)M]$ risky. The single crossing property is used in the derivation of condition (59). We collect the above result in the following proposition.

Proposition 2.5.5. *Given the set-up, $2M < 1, M + \bar{C} \leq 1$, and $M > \bar{C}$, the optimal contract of the moneylender is to serve αM safe and $(1 - \alpha)M$ risky by offering the contract $([\frac{p_s y_s - v}{p_s(1-\bar{C})} - \frac{(p_s y_s - v - L)(\alpha M - \bar{C})}{p_s(1-\bar{C})}], 0)$ to the safe and $(\frac{(p_r y_r - v - L)[1 - (1 - \alpha)M] + L}{p_r}, 0)$ to the risky, and the bank serves the residual $(1 - \alpha M)$ safe and $[1 - (1 - \alpha)M]$ risky by offering the contract $([\frac{p_s y_s(1-p_r) - p_r y_r(1-p_s)}{p_s - p_r}] - v, [\frac{p_s p_r (y_r - y_s)}{p_s - p_r}] - v)$ to the safe and $(\frac{p_r y_r - v}{p_r}, 0)$ to the risky, where $\alpha = \frac{p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})[2M-1]}{2M[p_s y_s - v - L + (p_r y_r - v - L)(1-\bar{C})]}$, if $p_r y_r - v - L > \frac{p_s p_r (y_r - y_s)(1-2M)^2}{2M(1-\bar{C})+\bar{C}+v(1-2M)^2}$.*

In the case $M > \bar{C}$, $M + \bar{C} \leq 1$, and $2M \geq 1$ the contract given in proposition 2.5.4. constitutes a unique Nash equilibrium outcome if $p_s - p_r < p_r y_r - v - L$. Similarly in case of

$M > \bar{C}$, $M + \bar{C} \leq 1$, and $2M < 1$, the contract given in proposition 2.5.5. denotes a unique Nash equilibrium outcome if $p_r y_r - v - L > \frac{p_s p_r (y_r - y_s)(1 - 2M)^2}{2M(1 - \bar{C}) + \bar{C} + v(1 - 2M)^2}$. The bank earns positive profits by serving the residual market not served by the moneylender and has no tendency to undercut. The moneylender is serving its full capacity and hence by lowering repayment further it cannot increase its profits. Also, since moneylender is offering a repayment to its clients such that bank is indifferent, it has no tendency to charge any higher repayment rate. As in the previous case, $M \leq \bar{C}$, this outcome rules out the possibility of a zero-profit contract on the part of both the bank and the moneylender.

We have considered two specifications of capacity constraint above, one is when $M \leq \bar{C}$ and the other is when $M > \bar{C}$. In both these cases, capacity is relatively smaller as $0 < M < 1$. It implies that the moneylender cannot serve the whole of risky or the safe at the same time. We have derived the Nash equilibrium outcomes in each case. In reality, different configurations of capacity constraints are possible. One possible case can be $1 < M < 2$. In this case capacity is relatively large as the moneylender can serve either the safe or the risky segment entirely but it is not enough to serve all borrowers. We check if zero profit outcome can be a Nash equilibrium outcome when the moneylender's capacity is sufficiently large.

Suppose moneylender offers a zero profit contract, $(\frac{L}{p_s}, 0)$ to the safe and $(\frac{L}{p_r}, 0)$ to the risky. It can serve all risky and some safe or all safe and some risky or a combination of safe and risky to exhaust its capacity M . We examine if a zero profit outcome is optimal for the bank. If moneylender serves all risky and $(M - 1)$ safe, bank can serve the residual safe borrowers $[1 - (M - 1)] = (2 - M)$ at a contract $(\frac{p_s y_s - v}{p_s}, 0)$ such that it extracts all surplus from the safe and earn positive profits. That is,

$$\pi^B = [p_s(\frac{p_s y_s - v}{p_s}) - L](2 - M) = [p_s y_s - v - L](2 - M) > 0$$

Similarly if moneylender serves all safe and some risky, bank can make positive profits on the residual risky segment $(2 - M)$ by offering a contract $(\frac{p_s y_s - v}{p_s}, 0)$. The bank may offer this contract because it cannot distinguish between the safe and the risky. So by offering this contract it can attract both safe and risky. The profits are as follows,

$$\pi^B = [p_r(\frac{p_s y_s - v}{p_s}) - L](2 - M) = [\frac{p_r}{p_s}(p_s y_s - v) - L](2 - M) > 0$$

From figure 1, we have that $\frac{L}{p_r} < \frac{p_s y_s - v}{p_s} \Rightarrow L < \frac{p_r}{p_s}(p_s y_s - v) \Rightarrow \frac{p_r}{p_s}(p_s y_s - v) - L > 0$.

In the case when moneylender serves some safe and some risky, moneylender gets to serve

some residual safe and some residual risky without involving in competition with the moneylender. Since the bank cannot distinguish between a safe type and a risky type, it can offer a contract $(\frac{p_s y_s - v}{p_s}, 0)$ which is affordable to both the types and the risky clients get some surplus because $\frac{p_s y_s - v}{p_s} < \frac{p_r y_r - v}{p_r}$. Suppose where the bank splits the residual $(2 - M)$ market between the safe and the risky clients in some ratio $\gamma : 1 - \gamma$. Then the profits are,

$$\begin{aligned}\pi^B &= [p_s(\frac{p_s y_s - v}{p_s}) - L]\gamma(2 - M) + [p_r(\frac{p_s y_s - v}{p_s}) - L](1 - \gamma)(2 - M), \\ &= [p_s y_s - v - L]\gamma(2 - M) + [\frac{p_r}{p_s}(p_s y_s - v) - L](1 - \gamma)(2 - M) > 0\end{aligned}$$

From the above, we observe that the bank can always earn positive profits by serving the residual segment by offering a contract that extracts all surplus from its borrowers when moneylender's capacity is sufficiently large but not enough to serve all. Thus, a zero profit outcome such as (L, L) for the safe and $(\frac{L}{p_r}, 0)$ for the risky or any other contract such as (L, L) for both the types is not optimal for the bank and hence is not a Nash equilibrium outcome. This is unlike the case where none of the lenders have any capacity constraint. Thus, we arrive at an important result from our analysis that whenever lenders are involved in strategic interaction with each other and the moneylender has capacity constraint of some form, a zero-profit outcome is never a Nash equilibrium outcome.

2.6 Conclusion

We present an explanation of credit market segmentation in a simultaneous move single shot game between a formal lender(bank) and an informal lender(moneylender). The bank cannot identify the type of a borrower(safe or risky) while the moneylender is constrained by capacity. Borrowers differ in risk and wealth and wealth is collateralizable. The Nash equilibrium strategies of the lenders is determined by the magnitude of the difference between the expected returns from risky and safe projects where the risky project has higher expected returns. The outcome is such that the credit market is segmented in terms of risk and wealth of borrowers, irrespective of whether the lenders compete or not. In case of competition between the lenders and when there is no capacity constraint, there are possibilities of multiple equilibria, one providing positive but less than the monopoly profits and the other outcome provides zero profits to both the lenders. Another important result of our model is that in case of capacity constraint of the moneylender, a zero-profit outcome is never a Nash equilibrium outcome as lenders earn positive profits. The single crossing property is satisfied in all the results.

When there is capacity constraint of the informal lender (the moneylender) and the available capacity is relatively small, competition between the lenders leads to rationing of the poorer safe borrowers under certain condition. This finding has severe implications for developing economies. The developing economies have a sizeable fraction of poor borrowers who may be willing to invest in safe projects to earn higher income. The possibility of being rationed in credit market may act as a low income trap for them. This is in line with findings from other empirical studies. Ding and Abdulai (2020) in the context of rural China find that formal loans are usually granted to projects that are more profitable(economically viable), thereby creating a vicious circle for who are rationed. Similar results are found in Meager (2019, 2022) who suggests that there is always a segment of borrowers, particularly those without prior business experience who do not benefit from micro-credit expansion. In line with these studies, our model predicts that relatively poorer borrowers with safe projects are more likely to be rationed in the formal sector, and also in the informal sector when the informal lender has limited capacity, and thus points to a potential poverty trap for a specific segment of borrowers.

We share some similarities with other studies that model strategic interaction between formal and informal lenders, and at the same time that echo the concern that when informal lenders co-exist with formal lenders, expansionary formal sector policies may not be helpful. For instance, Bardsley and Meager (2019) present an interesting set-up in their model where they examine conditions under which the market for the poorest borrowers may collapse when micro-credit institutions and informal lenders are involved in strategic interaction with each other. In a similar manner, Wang (2022) suggest that when households rely on informal lenders to meet their credit needs, any expansionary formal sector policies for borrowing could generate adverse effects on informal savings opportunities for households.

Consistent with the theoretical literature, empirical evidences from several developing countries also point out that there are always spill-over effects on the local informal credit market whenever there is entry of formal lenders(Berg et al., 2015; Demont, 2016; Islam et al., 2015). In case of India, Demont (2016) finds that MFIs attract a disproportionately safe share of borrowers away from the incumbent moneylenders, raising their rates of interest. Likewise, Islam et al. (2015) find in the context of Bangladesh that availability of MFI credit did not reduce the amount of loan borrowed from informal lenders for the very poor households, suggesting that MFI access might fill the gap between their actual credit demand and the limited sup-

ply of credit from informal lenders, rather than substituting informal loan. Another study in Bangladesh by Berg et al. (2015) suggests that entry of MFI has quite heterogeneous effects on the rates of interest charged by informal lenders, and it is for a higher coverage of MFIs that increased rates of interest of moneylenders. In terms of our model's predictions, we find that the credit market is segmented with respect to risk type and wealth level of borrowers. Though our model is not that of an entry model, we find that when bank and moneylender interact, the risky borrowers are served by both the lenders and leads to a poverty trap for safe type projects. Also, the bank caters to the wealthier segment of the safe while the moneylender serves the poorer segment who do not have the necessary collateral to afford bank loan. This is a segmented outcome. A similar type of outcome is found in Mookherjee and Motta (2016) that when MFI enters a local credit market under certain conditions, moneylender rate of interest increases although demand for moneylender credit falls. MFIs attract all the high risk borrowers due to their informational disadvantage while moneylenders are left with low risk (high return) clients from whom moneylenders can charge higher interest rate due to their market power. It emerges from our model that the government should devise policies to ensure credit availability to the poorer segment of the society.

Chapter 3

The role of financial and physical assets as substitute or complementary to land as collateral in credit market: Evidence from Indian households

3.1 Introduction

Land is considered to be the most dominant form of collateral particularly in the formal credit sector¹ in developing economies. In presence of asymmetric information, lenders may use collateral in combination with rate of interest in order to screen borrowers according to their degree of riskiness (Besanko & Thakor, 1987). Due to its immobility, it reduces monitoring and enforcement costs of lenders (Feder & Feeny, 1991; Hoff & Stiglitz, 1990). Further, in the event of default, it can be easily liquidated without incurring high costs to the lenders (Binswanger & Rosenzweig, 1986b; Feder & Feeny, 1991; Krishnan & Panchapagesan, n.d.; Narayanan & Chakraborty, 2019; Sanjak, 2012). There are ample evidences supporting the prevalence of land as collateral particularly in the formal credit sector in India and elsewhere. As per the report of 70th round (2012-13) of All India Debt and Investment Survey (AIDIS), among households owning less than 0.01 hectares, only 15% of outstanding loans are formal; while as high as 79% of formal loans are obtained by households with more than 10 hectares of land. Moreover, loans backed by land collateral are larger in size than loans backed by other collaterals like bullions and ornaments, financial assets, third party guarantees, personal security, etc. Other studies include Feder et al. (1988) in context of Thailand, Carter and Olinto (2003) in case of Paraguay, Dower and Potamites (2010) in context of Indonesia, to name a few. These studies find land ownership to significantly increase access to formal credit.

This often leads to rationing² of poor households from formal credit market, as they cannot afford the necessary collateral (Binswanger & Rosenzweig, 1986a; Chaudhuri & Cheral, 2012; Conning & Udry, 2007; P. Ghosh, Mookherjee, Ray, et al., 2000; Kochar, 1997; A. Kumar et al., 2017; S. Pal, 2002; Yadav, Otsuka, & David, 1992). This is where the allocative inefficiencies of land as collateral come into play. When the volume of loan increases with the size of land ownership, it essentially means that the landless, marginal and small land owners will be constrained by the availability of credit to invest in profitable projects (Feder et al., 1988; Sanjak, 2012). The equity concerns are further aggravated by the fact that borrowers must get entitled to property rights on their land in order to be able to pledge it as collateral, which often involves high and fixed transaction costs and is affordable only to the wealthier segment of the society (Feder & Feeny, 1991). Thus, other than the ownership of land itself, the associated

¹Formal lenders (e.g., banks) neither have information about relevant borrower characteristics nor use social ties to enforce repayment, while informal lenders (e.g., MFIs, moneylenders) do both. For instance, MFIs rely on the concept of peer monitoring, while moneylender or employer can use violent means to enforce repayment (Andersen & Malchow-Møller, 2006; Jain, 1999; Karaivanov & Kessler, 2018).

²Rationing can be complete or partial. See for e.g., P. Ghosh and Ray (2016).

process of getting land titles increases stratification of the society.

Land as a collateral also has certain limitations. An important problem is the illiquid nature of land, especially in the rural areas which reduces the marketability of the asset, thus making it less effective as collateral (Binswanger & Rosenzweig, 1986b; Chakravorty, 2013; Feder & Feeny, 1991). A related problem is when land is possessed in forms not acceptable as collateral (joint ownership of lands, encroachments, and temple lands, etc.) or when land parcels are transferred to farmers under land redistribution programmes of the government. These types of properties are not marketable and hence cannot be used as collateral (Herath, 1996; Pender & Kerr, 1999). In addition, developing countries are often characterized by structural bottlenecks (social, political factors) which may prevent foreclosure of land in case of default (Feder et al., 1988; Krishnan & Panchapagesan, n.d.). For example, when a considerable fraction of borrowers default, it may lead to political unrest. In this regard, Domeher and Abdulai (2012) suggest that lenders may avoid taking any collateral when loan amounts are relatively small as the legal framework may cause difficulties in seizing and selling the asset upon default.

In light of the evidences which discuss about the usefulness of land collateral, and also point towards the associated problems, it is also observed that the landless households do get loan. The Indian Human Development Survey (2011-12) report suggests that about 49.77% of all borrowers are landless, while 36.05% of borrowers who obtained their largest share of credit from formal sector are landless. It raises an important question as to what enables the landless borrowers to get credit. They might have other types of wealth, such as physical assets and financial assets that can make them creditworthy before the lenders. If this is the case, we can say that such assets act as substitute to land. On the other hand, it could also be the case that these assets increase the chances of getting loan when they are combined with land, in which case they are complementary to land. Therefore, this study makes a novel attempt to understand the nature of association between land and other assets in enabling credit access for Indian households. We also examine if this relationship differs between formal and informal credit sectors. This remains our first important contribution to the existing literature. Other than collateral, lenders sometimes use the purpose of loan application as a screening instrument to identify borrower types as it indicates the inherent riskiness (or immediate and direct return) from the project (Barslund & Tarp, 2008; Pham & Lensink, 2007; Tsukada et al., 2010)³. For instance, formal and semi-formal lenders give loans mostly for business purposes, while informal

³But, one cannot say how the loan is actually utilized since any loan is ex-post fungible (Tsukada et al., 2010).

loans are advanced primarily for consumption purposes. Though previous studies have considered loan purpose as a variable in their model, the possibility that loan purpose and wealth could be related is left unexplored. Thus, our second research question is to understand the nature of association between purpose of loan and the wealth variables. Suppose there are two applicants, one wealthy and the other poor and both of them apply for a business loan. Given that a business loan is productive (has income generating potential), if the lender approves the wealthy, we can say that wealth and loan purpose are complementary. In other words, having more wealth reinforces the positive effect of a productive project on credit access, if any. We further examine this relationship in getting formal vis-à-vis informal loans.

On a methodological front, we address the following key econometric concerns. First, we note that credit access is both a demand side decision (coming from households) and supply side decision (coming from lenders). When a given household reports not having a loan, it could either mean that it did not apply in the first place because it had no demand or it could mean that it had applied for a loan but was rejected. We incorporate this information in the empirical analysis by effectively distinguishing between two categories of households, those who do not apply and those who apply because they have demand⁴. Therefore, we restrict our study sample to the pool of applicants to infer the extent of rationing correctly.

Second, we suspect that our asset variables (physical and financial) could be endogenous to credit market outcome. One source of endogeneity is simultaneity, for example, possession of assets may help to get a loan, which in turn can lead to acquisition of more assets. Another source of endogeneity is omitted variable(s) which is (are) correlated both with the assets and the credit outcomes (dependent variables). For instance, a borrower's credit history could influence the lender's decision, while at the same time the borrower may sell off his assets to repay loan which could improve his credit ratings. In either case, assets are correlated with the error term and hence are endogenous. We adopt an instrumental variables (IV) framework to address these concerns.

Further, we note that we cannot rule out the possibility of selection bias in household level studies like ours. Since the source of credit (formal/informal) is observed only for the approved households, the possibility remains that there could be non-random selection into the pool of borrowers, if the rejected and approved applicants differ. We account for this by introducing

⁴Most empirical studies incorporate only the loan approval decision when modeling credit access. One exception is for example, S. M. Kumar and Venkatachalam (2019) who examine caste based differences in farmer's access to formal loan by considering both loan application and approval decisions in their study.

instrumental variables in Heckman probit model.

Using a nationally representative data for Indian households, we find that both physical assets and financial assets increase the probability of getting formal credit for the landless, suggesting a substitution role. Further, a complementarity is observed between land ownership and financial instruments, and between land ownership and loan purpose, especially productive investments in case of formal credit market. We also find an interesting pattern of association between occupation status of borrowers and their credit access, this relationship being centered on land ownership. On one hand, households engaged in salaried jobs and other allied professions and on the other hand, the labourer class and those involved in low income jobs both have lower chances to get a loan, and particularly to get formal loan relative to the households engaged in cultivation and allied agriculture. We argue that these two categories of households make up about 97.07% of the landless borrowers, and their average size of land ownership is much smaller than the cultivators and the allied class, and this may lower their probability of credit access. However, our results suggest that being landless need not necessarily be a constraint for these borrowers, since we find evidence of substitutability of land ownership with financial and physical assets.

Though our data does not have information on the type of security (collateral) pledged against loans (which remains a limitation of our study), our results are suggestive of why land and/or other assets are likely to be used as collateral, and even in situations where no actual security is pledged, lenders are likely to grant loans to wealthier borrowers (Feder et al., 1988; Herath, 1996). For example, in case of Sri Lanka, Herath (1996) suggests that though both titled (landed) and untitled (landless) farmers obtained credit from the informal sector without pledging any security, the rate of interest was relatively higher for untitled (85%) than that for titled farmers (70%). Nevertheless, our study provides fresh evidence on the relationship among different forms of wealth in credit market. We both complement and contribute to the existing studies which find a significant role of land collateral in credit access. First, in line with the studies like Feder et al. (1988), Mohieldin and Wright (2000), Carter and Olinto (2003), Barslund and Tarp (2008), Dower and Potamites (2014), D. Pal and Laha (2015) and S. M. Kumar and Venkatachalam (2019), we re-establish the dominance of land in credit market because of its observed complementarity with financial instruments and with productive loan purpose. At the same time, our study also explains to some extent why looking beyond land as collateral is important for households with limited immovable property so that they are not constrained by the availability of credit to undertake productive investments (Narayanan & Chakraborty,

2019). This may be possible because we do find evidence of substitutability between land and the other assets in credit access.

The rest of the chapter is structured as follows. In section 3.2, we present a brief overview of the existing literature. Section 3.3 discusses the methodology of our study (data, variables and empirical strategies). In section 3.4, we discuss the instrumental variables in details and discuss results from the model estimation. Section 3.5 concludes with a discussion of the results in the light of the findings from previous studies and its implications in the credit market.

3.2 Related literature

3.2.1 Land ownership and credit access in the formal sector

Land is considered as an ideal collateral due to its immobility which reduces lender's monitoring costs and due to its appropriability because in the event of default, it can be easily transferred and can be liquidated without incurring high costs to the lenders (Besanko & Thakor, 1987; Feder & Feeny, 1991; Narayanan & Chakraborty, 2019; Sanjak, 2012). There are ample evidences in India and elsewhere which suggest the widespread use of land as collateral, particularly in the formal credit sector. Mohieldin and Wright (2000) find in the context of Egypt that formal lenders serve only those with sufficient wealth to pledge as collateral. Jia et al. (2010) comes up with a similar result in case of rural China. Similarly, Tsukada et al. (2010) find in Indonesia that around 84% of formal loans require collateral of which land and houses are the most prevalent ones. India is not an exception to this. D. Pal and Laha (2015) suggest that in India households that have higher land ownership (minimum two hectares) are more likely to be approved by formal lenders. A. Kumar et al. (2017) in their study of Indian farm households suggest a positive relationship between land size and formal credit access. Large farms constitute only about 7% of agricultural households but receive as high as 24% of total formal credit to agricultural households. On the contrary, marginal farms who make up 40% of farm households receive a proportionately lower share of only 17% of total formal credit.

A few studies conclude that even after adjusting for difference in land quality, farm size remains the most important determinant of formal credit access. Using data from four provinces of Thailand, Feder et al. (1988) find that the use of land collateral increases with farm size, adjusted for quality differences. Specifically, in equilibrium, it increases the size of formal credit

obtained by 55% as compared to a loan without any security. The existing literature has often discussed about the role of land titles as an indicator of the quality of land possession⁵. On one hand, land titles are a way to confirm the legal ownership of land by a borrower, so that the lenders may liquidate it without loss in case of default. On the other hand, titles signal the credit worthiness of the borrower to the lender (Carter & Olinto, 2003; Dower & Potamites, 2014). Using panel data of farm households in Paraguay, Carter and Olinto (2003) examine whether land titles have an impact on credit supply (or rationing) as a function of farm size of households. Their findings suggest that for farms owning less than 3 hectares of land, the land title status (titled or untitled) do not significantly change the probability of rationing, which is almost 100%. However, the distinction between titled and untitled farmers in terms of credit accessibility is evident for land ownership of more than 3 hectares. The rationing probability falls below 50% for a titled farm if it owns more than 15 hectares while for an untitled farm, the rationing probability falls below 50% for farm size of 35 hectares. In case of Indonesian households, Dower and Potamites (2014) indicate that land does not only function as a collateral but that it has an ex-ante informational role to lenders, that is, land titles have a signalling value to banks regarding borrowers' credit worthiness. They find that a formal land title increases a household's probability of getting a formal loan and also increases the average loan size relative to untitled borrowers. This study further distinguishes between the first time borrowers without established credit histories and the repeat borrowers and find that merely having a land title and not offering it as collateral significantly increases the probability of getting formal loan for the first time borrowers relative to the repeat borrowers, which highlights the signalling role of land collateral.

3.2.2 Land, other assets and credit access

The existing literature has shown that other than land, there are a variety of goods used as collateral (security) against institutional and non-institutional loans in India and in other developing economies (Binswanger & Rosenzweig, 1986a, 1986b; Mowl, 2016; Narayanan & Chakraborty, 2019; Ramachandran & Swaminathan, 2002; Yadav et al., 1992). Binswanger and Rosenzweig (1986b) examine the relationship between household's current asset position and their chances of getting credit in rural South India. They find that wealth in the form of physical asset and financial assets is significant in getting loan from banks as well as non-

⁵For example, Herath (1996) suggests that in developing countries, land is often possessed in forms not acceptable as collateral, for instance, as joint ownership of lands, encroachments, and temple lands, etc. Land held in such forms has no property rights.

eylenders. For given wealth, those who have invested in land are more likely to get credit from government agencies but less likely to get from moneylenders, commercial banks and cooperatives. In case of Nepal, Yadav et al. (1992) conclude that land is a crucial collateral for formal sector borrowing while not important for informal lenders (friends & relatives and moneylenders).

It is a common observation in India that moneylenders can also be the nearby shopkeepers, who can take different durable goods as collaterals. For instance, Ramachandran and Swaminathan (2002) from a study of two Indian villages find that formal lenders accept as collateral immovable assets such as land and buildings, and only movables like gold and promissory notes, while informal lenders accept a diverse variety of assets ranging from land, buildings, gold, jewellery to brass vessels, other household goods. A similar study by Mowl (2016) denotes the prevalence of a wide variety of items ranging from land, vehicles to mobile phones as collaterals both in rural and urban areas in Tamil Nadu.

A recent study by Narayanan and Chakraborty (2019) suggests the diversity of collateral use in credit transactions in India. Using data from the All India Debt and Investment Survey of 2012-13, this study finds that while unsecured loans are more prevalent among rural (61.8%) and urban (58.1%) areas, but when it comes to secured loans, there is diversity in the type of collateral used. Further, a difference can be seen in the use of immovable property like land between the rural and the urban regions. Among secured loans, use of land is significant in urban areas but not the highest (about 9.3% of institutional loans are backed by land while it is 1.2% for non-institutional credit). But, in rural areas, land is the most dominant form of collateral used, and this is 22.2% for institutional loans and 1.7% for non-institutional loans. In a similar manner, bullions, ornaments and financial assets as collaterals are more prevalent in urban areas than in rural areas, and these assets are used more for institutional loans than for non-institutional loans across both rural and urban areas. The report also reveals that bigger sized loans are obtained using land as a security, and this figure is more for urban areas (Rs. 5,61,400) than for rural areas (Rs.91,900).

3.2.3 Is there a limited use of land in credit market?

Though land is preferable collateral among lenders, there are certain problems with the utilization of land, particularly in a developing economy setting. First, a major problem relates to the equity concerns associated with land collateral. When the size of loan granted increases with

the size of land ownership, clearly, landless and marginal land owners will have less opportunity to borrow larger credit to undertake profitable investments, thereby leading to inefficiencies in credit allocation (Feder et al., 1988). Moreover, the risk of losing land due to unsuccessful project is more for the small and marginal land owners and as such they are less likely to offer their land as collateral (Sanjak, 2012). According to Feder and Feeny (1991), an important reason that may aggravate the equity problem pertains to getting security rights on land. There is a fixed transaction cost involved while pledging land as security. This includes, for example, getting advice from expensive lawyers and it is the wealthier and large land owners who can afford to finance these costly transaction costs. Thus, other than the ownership of land itself, the associated process of getting land titles increases stratification of the society.

Second, the ability to use land as effective collateral is mostly contextual: while it may work in some cases, it may not in other context (Sanjak, 2012). One such factor is the location of the asset which determines the degree of marketability and transferability of the collateral. This is basically associated with the illiquid nature of rural land markets (Binswanger & Rosenzweig, 1986a; Chakravorty, 2013; Deininger, Jin, & Nagarajan, 2009; Domeher & Abdulai, 2012; Feder & Feeny, 1991; Herath, 1996). In rural areas which is dominated mostly by poor people, land registration may not increase value of land and make it more marketable because the 'price-enhancing' effect of land registration will be more than offset by the 'price-depressing' effect of the rural and deprived location of land. This leads to a trade-off as it is the rural poor who need credit the most (Domeher & Abdulai, 2012). Land markets are active when these are close to urban areas and are from agriculturally prosperous regions. On the other hand, land markets in remote areas, for example, in tribal regions have very few transactions partially due to laws which restrict sales (Chakravorty, 2013). According to Feder and Feeny (1991), assignment of land property rights often requires complex documentation and affidavits which has very limited applicability in rural areas. Thus, rural land markets are relatively inactive. Similarly, Herath (1996) mentions that in developing countries, land is often possessed in forms not acceptable as collateral, for instance, joint ownership of lands, encroachments, and temple lands, etc. Such lands have no property rights and hence cannot be used as collateral. According to Binswanger and Rosenzweig (1986a), the illiquid nature of rural land markets can also be attributed to presence of credit constraints. Open transactions in land are very limited because in presence of credit constraints, landless, marginal and small land owners are unable to purchase land, which essentially means that land market is confined to large land owners and those with access to credit. Deininger et al. (2009) also find evidence that imperfections

in credit market are responsible for distress sales of land in rural India.

A third and related problem is regarding the foreclosure of land in the event of default. Due to structural bottlenecks (social, political factors), lenders may not be able to seize the land and sell it without a significant loss in value after default (Feder et al., 1988; Krishnan & Pan-chapagesan, n.d.). An example of foreclosure problem would be when there is a huge fraction of borrowers in the economy who default. More than the monetary costs associated with the foreclosure, a more serious concern is the political unrest that may prevail in the society with many borrowers defaulting. In fact, studies suggest that in developing countries, lenders may avoid taking any collateral when loan amounts are relatively small as the legal framework may cause difficulties in seizing and selling the asset upon default (Domeher & Abdulai, 2012). The problem of land sale (foreclosure) may also arise when land parcels are transferred to farmers under land redistribution programmes of the government. These assigned lands cannot be mortgaged and are not marketable and transferable, which may limit its usefulness as collateral. The study by Pender and Kerr (1999) in two villages of Andhra Pradesh (Aurepalle and Dokur) examines whether possession of assigned lands adversely affect access to credit vis-à-vis titled lands which are marketable. However, this study finds that ownership of assigned land has no significant impact on credit access, both formal and informal. As the authors argue, this result could be driven by the fact that lenders may not rely on land to screen borrowers and to enforce repayment, or land may be less marketable than other assets, or when there are constraints which prevent lenders to recover the pledged asset upon default. In all these cases, land sales restrictions will have little impact on credit supply.

In line with the above discussion, studies indeed point out a limited use of land collateral in less developed and developing countries. For instance, Sarap (1991) examines the collateral system in six villages in Orissa and find that marginal and small farmers use land as collateral only during emergencies (medical or marriage expenses) where demand for loan is inelastic. Rather, poor farmers prefer using gold and brass utensils as collateral due to relatively lower risk associated with these assets. Feder et al. (1988) find in their study that use of land increases in farm size and that land is used as collateral only in areas where these are legal. For instance, In India, 65% of formal loans were backed by land collateral from farmers. Similarly, this figure was comparable (63%) in Thailand. The authors mention transaction costs, foreclosure problems and social and institutional factors as responsible for the limited use of land as collateral. In a recent study, Narayanan and Chakraborty (2019) also suggest that unsecured loans based

on personal security are dominant both in rural and urban areas of India. Households with smaller land ownership have a tendency to use bullions/ornaments as collateral over land while a reverse pattern is seen in case of land rich households. Land is pledged as security used to meet larger credit needs or during emergencies. This pattern is obvious despite the fact that legal ownership of land is clear in majority of the cases.

All these studies raise a common concern that may be there is a need to look beyond land since its suitability as collateral depends on a host of factors as discussed above. This gives the motivation behind the present study. We exploit the information on land ownership status (i.e. whether or not a given household owns land) from our data to explore our research questions.

3.3 Methodology

3.3.1 Data Source

We use data from the second round (2011-12) of India Human Development Survey which is a nationally representative, multi-topic survey of 42,152 households in 1,420 villages and 1,042 urban neighborhoods across India(Desai et al., 2015). We do not use the first wave (2005) of the IHDS along with the second round (2011-12) because the second round provides a richer set of data relevant for our study. Specifically, the first round does not provide the information on loan application choices of households, financial instruments (one of the key explanatory variables) and some of the instrumental variables used in the present study. The second round does contain all these information.

We resort to a truncated sample consisting only of applicants which is 23,699 households. Of this, the number of approved households stands at 22,630. In this study, landless shall refer to those with no ownership of land. It is a dummy taking value 1 if a given household has no ownership of land, and zero otherwise. Though some studies define landless as people with no ownership or operational holdings of land⁶, we do not consider operational holdings because it includes land rented in/leased in and lenders may not consider it in loan decision(Kochar, 1997).

The All India Debt and Investment Survey (AIDIS) of 2012-13, which is a nationally representative large scale survey on Indian households also suggests a widespread prevalence of land

⁶See for example, Ramachandran and Swaminathan (2002).

collateral in both rural and urban areas of India. Specifically, in urban areas, about 9.3% of institutional loans and 1.2% of non-institutional loans involve the use of land as a security. However, the use of land as collateral is relatively higher in rural areas (about 22.2% for institutional loans and 1.7% for non-institutional loans).

3.3.2 Econometric model

Our primary question is to understand the nature of association i) between land and other assets and ii) between the asset variables and the loan purpose in accessing formal credit vis-à-vis informal credit.

We suspect that physical assets and financial assets are endogenous in the model. One source of endogeneity is simultaneity where the dependent and independent variables are simultaneously affecting each other. Possession of assets may help to get a loan, which in turn can lead to acquisition of more assets. Another channel of endogeneity is that of omitted variable(s) which is (are) correlated both with the assets and the dependent variables. For instance, a borrower's credit history⁷ could influence the lender's decision, while at the same time the borrower may sell off his assets to repay loan which could improve his credit ratings. In either case, assets are correlated with the error term and hence are endogenous. However, we note that land ownership is unlikely to be endogenous because it is not easily traded (bought or sold) in the market like other assets (Steiner, Giesbert, & Bendig, 2009)⁸. Further, the study by Deininger et al. (2009) suggests that ownership of non-land assets does not facilitate purchase or sale of land. As for our study, we take comfort in the fact that in our sample only 1.55% of the households report having obtained their loan for buying land. Since we do not observe the source of endogeneity, we adopt a general approach, that of instrumental variables (IV) to address these concerns. We take the following instruments for physical asset index: a) an index of the major events experienced by the household in the last five years preceding the date of the survey and b) an index of wedding gifts prevalent in the community of the household. For financial asset index, we use a) level of confidence the household has on the banking institutions to keep their money safe, b) an index of the major events experienced by the household in the last five years, c) an index of the benefits received from (or participation in) various social/insurance schemes. We discuss in details about the choice of the instrumental variables in section 3.4.3 of the chapter. However, since the credit source is observed only for a clearly defined subset of the population,

⁷It is an unobservable in our case as data on this variable is not available.

⁸Steiner et al. (2009) find in their survey area that land is mostly acquired through inheritance.

i.e. the approved applicants, there is a potential concern of endogenous or non-random selection into the pool of borrowers, if we consider only the approved households for our analysis. Selection bias occurs when the approved are characteristically different from the rejected (Marchenko & Genton, 2012; Wooldridge, 2010). Table 1 below gives the t-tests of means/proportions of the observed covariates between the approved and rejected applicants⁹. We find that the two groups differ significantly across these variables except for the index of financial assets. Another source of selection bias could result from unobservable factors which are correlated with both whether or not any credit is approved and the source of this credit (formal or informal). For example, households who have a good credit history (an unobservable) are not only likely to be approved by any lender in general, but have better chance to obtain credit from formal lenders. Therefore, we address the issue of endogeneity in a sample selection framework. We estimate a Heckman Probit model taking care of endogeneity issues through two stage least square methods.

Table 1. t test of means/proportions between approved and rejected households

Variables	Mean (approved HH)	Mean (rejected HH)	Difference in means/proportions	Std. error
land owned acres	5.50	3.40	2.102***	0.22
log cons exp	11.55	11.51	.045***	0.01
hslid size	6.13	5.98	0.142***	0.04
age of head	49.59	51.41	-1.817***	0.19
educ highest	8.37	9.29	-0.925***	0.07
physical asset index	0.07	0.09	-0.018***	0.00
financial asset index	0.16	0.16	0.00	0.00
years in place	79.75	70.98	8.77***	0.34
Hindu	0.83	0.80	0.028***	0.01
upper caste	0.24	0.31	-0.071***	0.01
male head	0.90	0.89	0.008*	0.01
urban	0.29	0.38	-0.09***	0.01
landless	0.49	0.61	-.126***	0.01

Notes: This table presents test of means (of continuous variables) and test of proportions (of dummy variables) between approved and rejected households. All estimates are survey weighted. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: Author's calculation using IHDS-2, 2011-12 data.

We employ the sample selection model given by Van de Ven and Van Praag (1981) which is applicable when both dependent variables are binary¹⁰. Accordingly, we estimate the model in two stages. First, the probability of loan approval is modeled on the vector of explanatory variables, called the selection model. Second, conditional on approval, the probability of this

⁹The definition and summary statistics of the explanatory variables are provided in table 2 below.

¹⁰Originally, Heckman (1979) introduced the sample selection model in case of continuous dependent variable.

loan being formal is modeled on the same set of variables, called the outcome model¹¹. Here, it is important to note that the selection model is explaining the overall credit access for the households. We also note that in the outcome model, we use information on the ‘largest loan’ for a given household rather than any loan obtained because it is usually the case that it should ideally apply first to that sector from which it expects to meet most of its credit requirements, after which it may resort to other lenders for any unmet demand (Bell et al., 1997). We estimate the following selection model augmented with an IV framework.

$$anyloan_i = \alpha_0 + \alpha_1 landless_i + \alpha_2 phyasset_i + \alpha_3 finasset_i + \alpha_4 landless_i * phyasset_i + \alpha_5 landless_i * finasset_i + \alpha_6 medlarge_i * finasset_i + \alpha_7 X_i + \alpha_8 yearsinplace_i + \mu_{1i}..(1)$$

$$largestformal_i = \beta_0 + \beta_1 landless_i + \beta_2 phyasset_i + \beta_3 finasset_i + \beta_4 landless_i * phyasset_i + \beta_5 landless_i * finasset_i + \beta_6 medlarge_i * finasset_i + \beta_7 loanprod_i + \beta_8 loanprod_i * landownership_i + \beta_9 loanprod_i * phyasset_i + \beta_{10} loanprod_i * finasset_i + \beta_{11} X_i + \mu_{2i}, \forall anyloan_i = 1..(2)$$

$$phyasset_i = p_0 + p_1 majorevent_i + p_2 wedgift_i + p_3 X_i + v_i....(3)$$

$$finasset_i = f_0 + f_1 majorevent_i + f_2 confbank_i + f_3 socialbenefit_i + f_4 X_i + w_i....(4)$$

Here, $anyloan_i$ is the selection variable which takes a value 1 if a loan is approved and zero otherwise, for the household i , and $largestformal_i$ equals 1 if the largest loan is obtained from formal sector and zero otherwise. We note that $largestformal_i$ is observed only when $anyloan_i = 1$. The variables on the right hand side are self-explanatory. X_i represents the vector of covariates affecting the selection and outcome variables. Here, u_{1i} and u_{2i} are residuals from the two models following a bi-variate standard normal distribution with correlation coefficient ρ . When $\rho \neq 0$, then standard probit techniques applied to the outcome equation yield biased results (Heckman, 1977; Van de Ven & Van Praag, 1981). Equation (3) and (4) represent the reduced form equations of physical asset index and of financial asset index respectively. Here, X_i is the vector of exogenous variables and v_i and w_i represent the error terms in the respective equations.

¹¹We note that once a loan is approved, the source (formal or informal) is automatically known. Hence these are simultaneous decisions.

3.3.3 The identification strategy

The identification strategy requires that we include in the selection equation a variable (exclusion restriction) which determines the selection mechanism but should not influence the outcome. In our case, the number of years a household has resided in its current location (years in place) serves this purpose. We conjecture that this variable positively affects the loan approval decision but is unlikely to affect the loan source. Stability in a location is likely to affect whether or not one gets a loan, and this is irrespective of the type of the lender (formal or informal). For example, take the case of a bank which is a formal lender. It will get a proper address proof of a borrower who has been residing in a particular location for a longer time than someone who has started to live in that place recently. Therefore, the first borrower will have a better chance to get the bank loan. In a similar manner, an informal lender such as the moneylender may find it more convenient to monitor and enforce repayment on a borrower who has been living in a given location for a long time, than a new comer to that place. Therefore, stability in a given location increases the probability for any lender that the loan will be repaid and hence, the distinction in terms of the lending source is likely to be less important.

One might argue that if a household has lived longer in a place, it is more likely to run a successful business and get good returns, which may increase the chances of getting the largest formal loan. We use a simple method to justify our argument. First, a simple correlation analysis of years in place with loan approval dummy yields a coefficient of 0.13, while its correlation with the largest formal loan dummy is -.011 which is very small. Second, we regress each dependent variable on years in place controlling for all other covariates. We find an insignificant coefficient of years in place in case of largest formal loan (outcome model) and a significant coefficient in case of loan approval (selection model). Hence, years in place should serve as a valid exclusion restriction. We further note that the purpose of loan appears as a regressor in the outcome model but not in the selection model. Though it should be observed for all applicants, irrespective of whether or not the loan was approved, the data reports the loan purpose only for the approved¹².

¹²The specific question asked to the respondent in this regard is ‘For what purpose was the largest loan taken?’

3.3.4 Variables used in the study

In table 2, we define the explanatory variables used in the study and present the summary statistics. In this study, formal lenders include bank, government programs, credit programs such as Kisan credit card, LIC and provident funds. Informal lenders consist of moneylenders, employers, friends and relatives, microfinance institutions, self-help groups, NGOs etc. We have followed the literature while making this distinction (explained in note 1).

Table 2. Definition and summary statistics of variables

Variables (continuous)	Definition	Mean	Std. Dev
land ownership	volume of land ownership in acres	5.41	15.31
phyassetindx*	index of physical assets possessed by the HH	0.07	0.16
finassetindx*	index of financial assets possessed by the HH	0.16	0.17
log cons exp	logarithm of monthly consumption expenditures incurred by the HH	11.55	0.68
HH size	size of the household	6.12	2.88
HH head age	age of the HH head in years	49.67	12.92
highest educ	highest level of education attained by any member in the HH	8.41	4.91
years in place	no. of years a HH has resided in the current place	79.38	23.89
major event index(IV)*	index constructed with major events experience by the HH resulting in huge expenditure or loss of money	0.16	0.25
wed gift index(IV)*	index constructed with the wedding gifts prevalent in the community where the HH resides	1.32	0.71
social benefit index(IV)*	index constructed with benefits received from (or participation in) various social/insurance schemes	0.11	0.17
Variables (categorical)		Proportion	Std. Error
landless	dummy=1 if the HH does not own any land; 0 otherwise	0.5	0.04
medlarge	dummy=1 if the HH owns more than 9.8 acres of land; 0 otherwise	0.13	0.01
Hindu	dummy=1 if religion of the HH is Hinduism; 0 otherwise	0.84	0.01
upper caste	dummy=1 if the HH belongs to Brahmin or general caste; 0 otherwise	0.23	0.01
urban	dummy=1 if the HH resides in urban area; 0 otherwise	0.29	0
male head	dummy=1 if the HH is headed by a male; 0 otherwise	0.89	0
loanproductive**	dummy=1 if loan is obtained for productive purpose; 0 otherwise	0.43	0.01
salaried & others**	category=1 if primary occupation of the HH is salaried job, profession, organized business, and pension/rent etc.	0.14	0.02
labourers & others**	category=2 if the HH is engaged in wage labour, artisans, petty shop owners etc.	0.51	0.01
some confidence in banks(IV)**	category=1 denoting some confidence on the banking institutions to keep money safe	0.06	0
much confidence in banks(IV)**	category=2 denoting high confidence on the banking institutions to keep money safe	0.92	0

Notes: This table provides definition of the variables used in this study along with their summary statistics. *: calculation of these indices is explained below. **: components included in these categories are explained below. **IV**: instrumental variable.

HH: household. Source: IHDS-2, 2011-12.

We expect size of land ownership to have a positive and significant impact on the likelihood of obtaining a loan, and more particularly in getting a formal loan(Binswanger & Rosenzweig,

1986b). Since a given household can possess a number of physical assets and invest in different types of financial instruments, we construct an index for each type of asset. A respondent household was asked whether it possessed a particular asset, for e.g., car. Considering the binary nature of the items, we first construct a tetrachoric correlation matrix of all the items included under each asset and then run factor analysis on the matrices to construct the respective index. The index of physical asset includes the following items: house, cycle, sewing machine, mixer/grinder, scooter, television, cooler, air conditioner, clock/watch, electric fan, cot, chair or table, phone, car, credit card, refrigerator, pressure cooker, washing machine, computer and laptop. Similarly, the index of financial asset includes investments made by the household in mutual funds/shares/bonds, expansion in house or property, fixed deposits, bank savings or current account, chit fund/SHG/credit society account, post office account and gold & jewellery. We expect the asset variables to have a positive effect on the probability of getting a loan in general and more particularly to get formal credit as these can be used as collateral (Binswanger & Rosenzweig, 1986b; Pender & Kerr, 1999).

We classify the use of loan which has immediate return (short run) and directly leads to generation of return as productive. These include buying house, land, agricultural equipment, business, and purchase of vehicles. All other items are classified as unproductive. When classified in this way, some of the items like loans for household consumption, medical, educational and marriage expenses have come under unproductive purpose, because they do not lead to immediate return (Hulme, Montgomery, & Bhattacharya, 1996; Ramachandran & Swaminathan, 2002). The return from education is always with some lag and expenditures on medical purpose have indirect return through the enhancement of working capacity. Consumption expenditure increases well-being of people but without any direct contribution to income generation. In a similar manner, even though marriage leads to social mobility and increases access to kinship resources, it does not directly add to income. We create a dummy that is equal to 1 if the purpose of the largest loan is productive and zero otherwise¹³. We expect that productive loans are likely to increase access to formal loans as these bring direct and immediate returns.

¹³We do not have proper information on all relevant variables (terms and conditions) on which credit is accessed, for example, the type of collateral, the size of collateral and the rate of interest. Though information on monthly and annual rate of interest on the largest loan is reported in the data, it has missing values on annual interest rate for about 49.06% of borrowers and missing values on monthly interest rate for 37.63% of borrowers. When we tried converting monthly into annual rates to prevent loss in sample size, we find that missing information is reported only for 5.47% of the households. However, the interest rates are abnormally high for many of the observations. Hence, we do not include this variable in our model.

We classify primary occupation source into three groups based on land ownership status of the households. It is defined as a categorical variable that takes a value 0 for those whose main income source is cultivation and allied agriculture (this is the base category in our study); a value 1 for households who are engaged in salaried occupation, organized business, professions and those who earn income from pension/rent, etc.; a value 2 for those who are wage labourers (agricultural or non-agricultural), artisans, small unorganized businessmen petty shop owners and others. We have considered group 1 and 2 as separate because group 1 households have access to a certain source of income unlike households in group 2.

So far as the composition of the landless according to the type of occupation is concerned, we find that group 1 constitutes about 29.26% of the landless and group 2 make up about 67.81% of the landless. Together they comprise of 97.07% of the landless. The base group, on the other hand, has only 2.93% of the landless households. Thus, this categorization provides us with a clearer picture of the occupational composition of households according to their land possession. We hypothesize that group 1 and group 2 borrowers may have lower chances of loan approval, and more particularly in getting formal loan, because represent the landless chunk of the borrowers in this study and formal lenders usually prefer land rich borrowers (Binswanger & Rosenzweig, 1986b; Feder et al., 1988; A. Kumar et al., 2017).

We control for the household size and the monthly household consumption expenditures. A higher expenditure may indicate that the household is wealthy and hence more creditworthy. But it also indicates lower savings out of a given income and hence reduces repayment capacity. As such the sign of this variable is ambiguous. Similarly, a larger family size is expected to lower the probability of credit access as this could signal a higher dependency burden of the family and this may be more important to formal lenders than informal lenders. We also include in our model the caste and religion of the household. Upper caste households may be expected to have a higher chance to get formal credit (S. M. Kumar & Venkatachalam, 2019; Pender & Kerr, 1999). However, the same cannot be said about informal credit and thus its sign is ambiguous in the selection model. Likewise, the sign of religion is ambiguous a priori.

We also control for gender and age of the household head, the highest level of education attained by any member in the household. Male headed households may have higher chances of obtaining formal credit (Nikaido, Pais, & Sarma, 2015). Higher levels of education and higher age may increase reputation of the household (Pender & Kerr, 1999). At the same time,

educated people are better informed about loan terms and more capable of managing their finances (Nikaido et al., 2015). So, we may expect education to increase access to formal loan (that is, in the outcome equation). However, the same cannot be said about informal loans. As such education can take any sign in the selection model. Similarly, aged people are more experienced in terms of handling finances. But, as one ages, the income earning potential goes down. Hence, the net effect of age is ambiguous.

We capture the regional variation in credit access through the inclusion of a dummy ‘urban’ which takes a value 1 for households who reside in urban areas, and zero for rural dwellers. The sign of this variable is a priori ambiguous given that there is penetration of formal credit sector in both rural and urban areas (AIDIS, 2012-13). However, the AIDIS, 2012-13 report also suggest that the use of land collateral is significantly higher in formal credit sector in rural areas as compared with urban areas. As such, urban dummy may have a negative coefficient especially in the outcome model. In addition, we control for state fixed effects in the model to account for any time invariant unobserved variation across the states.

Mean size of formal-informal loan obtained by the landless and the landed groups

In table 2a we present the average size of the largest loan obtained by the landed and the landless households both from formal and informal sources across each occupational class. We also present the probability of loan approval for the two groups, conditional on their application.

Table 2a. Average loan size between landless and landed by credit source and occupation

Occupation	Loan size (formal)		Loan size (informal)		Approved (%)	
	landless	landed	landless	landed	landless	landed
Cultivation	116581.1	127341.9	39016.82	56011.69	97.40163	96.87347
Allied agriculture	84920	174372.5	57544.64	79123.88	91.77778	95
Agricultural wage labour	55530.2	56275.98	31831.77	38170.9	95.40921	97.34353
Non agricultural wage labour	102965	60538.46	33356.41	29226.19	95.92239	96.69141
Artisan/Independent business	194322	316629	58796.2	79404.26	91.52542	94.74836
Petty shop	318879.3	198519.1	57909.13	61023.15	96.27912	96.29847
Organized Business	463252.3	200523.8	188575.8	369400	92.2179	95.6962
Salaried	259252.7	176833.7	60721.95	60526.9	93.02675	96.15693
Profession	268400	243000	44509.87	78071.43	92.50814	91.36691
Pension/Rent etc.	225464.1	148407.4	60596.99	40301.48	88.0647	95.39683
Others	175372.1	247025	48624.91	77198.36	90.06711	97.82871

Notes: This table presents the distribution of the size of the largest for the landed and the landless households across formal and informal sources. The loan approval probabilities are also reported.

Source: Author’s calculation using IHDS-2, 2011-12 data.

A look at the average loan size between the landless and the landed reveals an interesting pattern. The size of formal loan is always higher for the landless than for the landed if they belong to group 1 (salaried job, profession, organized business, pension/rent etc.). This clearly suggests that land need not be a necessary factor for the well-to-do class (those with a certain source of income) to get formal credit. In addition, the non-agricultural wage labourers and petty shop owners also get a larger volume of formal loan when they are landless than when they have land. On the other hand, it is the landed rather than the landless who get a bigger size of formal loan if they are engaged in cultivation, allied agriculture or are agricultural wage labourers. This provides us with another justification for classification of households into the three occupational categories, as mentioned above. In case of informal loan, however, it is the landed group who get a larger loan size on average than the landless, and this is true for almost all types of occupational classes.

The All India Debt and Investment Survey of 2012-13 reveal that in urban areas, the average size of loan obtained is the highest when land is pledged as collateral (Rs. 5, 61,400). In rural areas also, the mean loan size is significantly higher in case of land collateral than against other forms of collateral (Rs.91, 900).

3.4 Results and discussion

In table 3, we present the results of probit model with sample selection (Heckprobit). We estimate three models here¹⁴. Model 1 is the base model which includes the wealth variables, loan purpose and their interactions while controlling for household level characteristics. Model 2 addresses the main objective of this study. The landless group is interacted with the asset indices to examine whether these enable them to get credit. In model 3, we address the possible endogeneity of physical and financial assets by using instrumental variables for each of them in the sample selection model. Thus, we may interpret the results of model 3 as causal effects of the asset variables on credit access of borrowers. We discuss the IV results in sub-sections 3.4.3 and 3.4.4.

¹⁴We exclude from the empirical analysis a few states that had zero or missing observations for the outcome dependent variable or the selection dependent variable. This was causing converge problems. These states include Chandigarh, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Sikkim, Daman & Diu and Pondicherry. As a result, 1.63% of the sample was lost. However, this should not change the main results of the study as the number of observations lost is very small.

The Heckman Probit model eliminates sample selection bias by estimating the Inverse Mill's ratio, which is based on the correlation between the error terms in the outcome and selection equations. A significant correlation coefficient ρ suggests that the IMR is significant and this indicates presence of selection bias in our study. This is evident in case of all three models that we estimate.

3.4.1 Selection model

In model 1, years of residence is associated with a higher probability of loan approval ($p < 0.05$), as expected. Land ownership increases the probability of getting a loan ($p < 0.05$). We include squared value of land to allow for non-linearities in the relationship. However, it is insignificant and does not capture the diminishing role of land, if any. Therefore, following the categorization of land ownership as per All India Debt and Investment Survey (AIDIS) of 2013, we create a dummy called medium to large land ownership (medlarge) which takes value 1 if land ownership exceeds 9.8 acres and 0 otherwise¹⁵. The negative and significant ($p < 0.05$) interaction effect of land ownership with this dummy suggests that role of land as collateral diminishes beyond 9.8 acres. A higher value of financial asset index is associated with a significantly higher probability of getting a loan ($p < 0.01$). However, we get a counter intuitive result that possession of more of physical assets significantly lowers the probability of getting a loan ($p < 0.01$). This is in contrast to previous studies which find evidence of use of physical assets as collateral in the credit market (Narayanan & Chakraborty, 2019). This may be because of endogeneity of physical asset index. We address this in details in the next section. We do not find sufficient evidence that financial assets are complementary to land as their interaction effect is insignificant.

We control for other household characteristics in model 1. A larger family size lowers the probability of getting a loan ($p < 0.1$). Higher monthly consumption expenditure is associated with a higher probability of getting a loan ($p < 0.01$). Hindu households are more likely to get a loan relative to the non-Hindus ($p < 0.01$). We find that households whose primary occupation are salaried jobs, professions, organized business and those who earn income from pensions, rent, etc. have a lower chance to get a loan approved relative to the cultivator class

¹⁵Households who fall under medium category owns more than 9.8 acres and those under large category possess more than 24.74 acres of land. We have considered other dummy specifications of land ownership, such as small and above (equals 1 and 0 otherwise), marginal and above (equals 1 and 0 otherwise) but these are insignificant.

and allied agriculturists($p < 0.01$). A similar result is obtained in case of the labourer class, petty shop owners and those engaged in small unorganized business($p < 0.01$). Higher age of the household head and higher education levels reduce the probability of getting a loan significantly($p < 0.01$). We find that urban households have a lower probability to get a loan vis-à-vis the rural households($p < 0.05$). These results are as expected. We control for state fixed effects in the model to capture any time invariant unobserved variation across the states. In model 2, the landless dummy is interacted with each asset index. The positive and significant interaction effect($p < 0.01$) of landless and physical asset index indicates that physical assets increases the chances of getting a loan for the landless households relative to the landed, thereby suggesting substitutability to land. However, we do not find any significant effect of financial assets for the landless in credit access. Thus, it is physical assets which facilitate credit access for the landless households. The results of model 1 are more or less preserved in this specification.

Table 3. Results of Heckprobit model

Outcome model	(1)	(2)	(3)
landownacre	0.0470*** (0.0030)	0.0319*** (0.0035)	0.0047*** (0.0014)
landsquare	-0.0000*** (0.0000)	-0.0000*** (0.0000)	0.0000 (0.0000)
loanproductive	0.8379*** (0.0177)	0.8170*** (0.0177)	0.2401*** (0.0158)
phyassetindx	1.6325*** (0.0713)	1.0504*** (0.0910)	6.0507*** (0.3442)
finassetindx	0.5082*** (0.0512)	0.3026*** (0.0682)	4.5668*** (0.2094)
log cons exp	0.1611*** (0.0123)	0.1611*** (0.0123)	-0.5810*** (0.0193)
HH size	-0.0185*** (0.0023)	-0.0181*** (0.0023)	0.0298*** (0.0022)
Hindu	0.0776*** (0.0162)	0.0646*** (0.0163)	-0.0029 (0.0120)
uppercaste	0.0893*** (0.0142)	0.0845*** (0.0142)	-0.1657*** (0.0124)
salaried & others	-0.0271 (0.0201)	0.0146 (0.0206)	-0.4218*** (0.0188)
labourers & others	-0.3160*** (0.0171)	-0.2594*** (0.0176)	-0.1166*** (0.0117)
male head	0.2047*** (0.0197)	0.2018*** (0.0198)	0.0630*** (0.0130)
HH head age	0.0062*** (0.0005)	0.0058*** (0.0005)	-0.0004 (0.0004)
highest educ	0.0338*** (0.0015)	0.0341*** (0.0015)	-0.0301*** (0.0018)
urban	-0.0889*** (0.0151)	-0.0657*** (0.0163)	-0.3056*** (0.0222)
medlarge×land	-0.0384*** (0.0028)	-0.0259*** (0.0032)	-0.0070*** (0.0011)
medlarge×finindex	0.8407*** (0.0943)	0.9384*** (0.1001)	0.2152*** (0.0329)
loanproductive×land	0.0093*** (0.0013)	0.0102*** (0.0013)	0.0033*** (0.0004)
loanproductive×phyindex	-1.0042*** (0.0800)	-0.9668*** (0.0810)	-0.2603*** (0.0303)
loanproductive×finindex	-0.4019*** (0.0686)	-0.3678*** (0.0690)	-0.1089*** (0.0227)
landless		-0.2843*** (0.0232)	-0.0901*** (0.0089)
landless×phyindex		0.9488*** (0.0860)	0.2916*** (0.0319)
landless×finindex		0.3608*** (0.0752)	0.1172*** (0.0247)
constant	-3.9341*** (0.1474)	-3.7823*** (0.1479)	5.5993*** (0.2634)
State fixed effects	yes	yes	yes
N	23,699	23,699	23,699

Selection model	(1)	(2)	(3)
years in place	0.0008** (0.0004)	0.0008** (0.0004)	0.0005** (0.0002)
landownacre	0.0122** (0.0054)	0.0172*** (0.0064)	0.0083** (0.0037)
landsquare	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
phyassetindx	-0.3667*** (0.0798)	-0.7279*** (0.1425)	-0.4794 (1.2435)
finassetindx	0.4847*** (0.0718)	0.4610*** (0.1255)	5.9460*** (0.1395)
log cons exp	0.1714*** (0.0194)	0.1723*** (0.0195)	-0.1928** (0.0934)
HH size	-0.0072* (0.0039)	-0.0078** (0.0038)	0.0079 (0.0062)
Hindu	0.1101*** (0.0252)	0.1085*** (0.0253)	-0.0202 (0.0173)
uppercaste	-0.0003 (0.0255)	-0.0012 (0.0256)	-0.0893*** (0.0295)
salaried & others	-0.2489*** (0.0424)	-0.2461*** (0.0411)	-0.3277*** (0.0583)
labourers & others	-0.1530*** (0.0333)	-0.1429*** (0.0326)	-0.0891*** (0.0196)
male head	-0.0015 (0.0302)	-0.0065 (0.0300)	-0.0527*** (0.0203)
HH head age	-0.0047*** (0.0008)	-0.0048*** (0.0008)	-0.0042*** (0.0006)
highest educ	-0.0141*** (0.0023)	-0.0141*** (0.0023)	-0.0262*** (0.0054)
urban	-0.0502** (0.0243)	-0.0658*** (0.0243)	-0.0057 (0.0647)
medlarge×land	-0.0116** (0.0051)	-0.0149** (0.0060)	-0.0082** (0.0034)
medlarge×finindex	0.2101 (0.2210)	0.3104 (0.2354)	0.1096 (0.1236)
landless		-0.0047 (0.0372)	0.0020 (0.0201)
landless×phyindex		0.5875*** (0.1514)	0.3744*** (0.0836)
landless×finindex		0.0270 (0.1514)	0.0616 (0.0818)
constant	-0.0068 (0.2320)	0.0044 (0.2339)	2.7927*** (0.9958)
State fixed effects	yes	yes	yes
N	22,630	22,630	22,630

corr(e.select,e.outcome)	0.5045*** (0.0591)	0.5104*** (0.0654)	0.7083*** (0.0813)
corr(e.Physassetindx,e.largestformal)			-0.6870*** (0.0351)
corr(e.Finassetindx,e.largestformal)			-0.7238*** (0.0265)
corr(e.Physassetindx,e.anyloan)			-0.0785 (0.1314)
corr(e.Finassetindx,e.anyloan)			-0.8462*** (0.0248)

Notes: This table presents estimates from probit model with sample selection. In model 1, we fit a sample selection probit model without taking care of the endogeneity of the asset variables. In model 2, interactions effect of landless dummy with physical asset index and financial asset index are considered. In model 3, we address possible endogeneity of the asset variables with the help of instrumental variables. All estimates are survey-weighted. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

3.4.2 Outcome model

Here, we examine the factors that affect the probability that the largest credit has been obtained from the formal credit sector, for the borrower households. Higher ownership of land significantly increases the likelihood of obtaining the largest loan from formal sector ($p < 0.01$), however, this effect diminishes beyond land ownership of more than 9.8 acres ($p < 0.01$). This result suggests that even though land is an acceptable form of collateral for all lenders in general (as seen from selection equation), it is more important in formal credit access, as implied by a higher significance level. Both physical and financial assets are associated with a higher chance of getting the largest formal loan ($p < 0.01$). This is intuitive because formal loans usually require collateral. These findings are consistent with the patterns observed for other less developed and developing countries. For example, in case of India, Narayanan and Chakraborty (2019) suggest that financial assets are more significant as collateral for formal (institutional) loans than informal (non-institutional) loans. Other studies with a similar finding include Yadav et al. (1992) in case of Nepal, Mohieldin and Wright (2000) in case of Egypt and Tsukada et al. (2010) in context of Indonesia. Productive investments are more likely to be financed by formal sector, relative to unproductive ones ($p < 0.01$). Similar patterns are reported by Barslund and Tarp (2008) and Pham and Lensink (2007) in case of Vietnam.

We find sufficient evidence that financial assets are complementary to land ownership when it comes to getting the largest credit share from formal sector ($p < 0.01$). One possible argument is that land rich households are more likely to invest in various financial instruments which

Table 3 (continued). Reduced form models of physical and financial asset indices

Variables	physical asset index	financial asset index
major event index	-0.0302*** (0.0017)	0.0232*** (0.0026)
wed gift index	0.0019*** (0.0006)	
social benefit index		0.1087*** (0.0042)
some confidence in banks		0.0112*** (0.0026)
high confidence in banks		0.0223*** (0.0023)
landownacre	0.0006*** (0.0001)	-0.0001 (0.0001)
landsquare	-0.0000*** (0.0000)	0.0000 (0.0000)
log cons exp	0.0710*** (0.0010)	0.0452*** (0.0012)
HH size	-0.0046*** (0.0002)	-0.0016*** (0.0002)
Hindu	-0.0061*** (0.0011)	0.0113*** (0.0016)
uppercaste	0.0198*** (0.0012)	0.0168*** (0.0015)
salaried & others	0.0461*** (0.0016)	0.0364*** (0.0022)
labourers & others	0.0034*** (0.0011)	0.0059*** (0.0016)
male head	-0.0052*** (0.0013)	0.0068*** (0.0017)
HH head age	0.0002*** (0.0000)	0.0002*** (0.0001)
highest educ	0.0045*** (0.0001)	0.0029*** (0.0001)
urban	0.0506*** (0.0011)	-0.0026* (0.0014)
constant	-0.7950*** (0.0124)	-0.4594*** (0.0149)
State fixed effects	yes	yes

Notes: This table provides the estimates of the reduced form regressions each of physical asset index and financial asset index on the set of instruments and the exogenous covariates. All estimates are survey-weighted. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

can further add to their credit worthiness. However, it is intuitive to assume that land rich households may not use physical assets (except house) as collateral, even if they own these. Hence, we avoid interaction of the ‘medlarge’ dummy with physical assets in both selection and outcome models.

We also find a complementary association between loan purpose and land($p < 0.01$), i.e., land is more important as collateral when loan is obtained for productive purposes. This is intuitive because on one hand, land is considered as good collateral and on the other hand productive investments are more likely to generate immediate returns and also the returns are earned directly, so that together they provide a better insurance to formal lenders. Interestingly, we find that both physical and financial assets reduce the probability of the formal loan when loan purpose is productive($p < 0.01$). We argue that since productive loans are larger in volume than unproductive loans (the average size of these loans are respectively Rs 1,14,077 and Rs 55,504 in our sample), land could be used to secure such loans because of its high value and marketability(Narayanan & Chakraborty, 2019; Sarap, 1991). However, physical assets consist mostly of durable goods and their value may not cover productive loans in case of default. Similarly, value of financial instruments may not be sufficient to cover such loans.

Households with higher consumption expenditures are more likely to get the largest formal loan($p < 0.01$). A larger family size reduces the probability of the outcome ($p < 0.01$). Higher age of head and higher education levels lead to higher chances of getting formal loan($p < 0.01$). Male headed households are more likely to meet their largest credit from formal sector vis-à-vis households with a female head ($p < 0.01$). This result is similar to Nikaido et al. (2015) who find that female owned enterprises have lower chances to get formal credit. So far as occupation is concerned, households in low income jobs like wage labourers, petty shop owners and small unorganized business class are less likely to get their largest formal loan relative to the cultivator and allied class($p < 0.01$). A similar pattern is observed for the salaried class and the like but the coefficient is insignificant. Urban households have lower chances to obtain their largest loan from formal sector than rural households($p < 0.01$). Upper caste and Hindu borrowers are more likely to get their largest loan from the formal sector relative to the lower castes and the non-Hindus, respectively($p < 0.01$). These results are as expected as discussed in section 3.4.

In model 2, the landless borrowers have a significantly lower probability to obtain their largest formal loan relative to the landed($p < 0.01$). This is an indication of dominance of land collateral in the formal credit sector. Narayanan and Chakraborty (2019) suggest a similar pattern in their study which is true for both rural and urban areas. Further, the positive and significant interaction effects of land with physical and financial assets suggest that these are substitutable to land as these help the landless to meet their largest credit from formal sector($p < 0.01$). Results of model 1 are preserved in this specification.

3.4.3 IV estimation

Instruments for physical assets

We use the following instruments for physical assets: a) an index of the major events experienced by the household in the last five years. These refer to shock(s) that resulted in huge expenditure or loss of money such as major illness/accidents, drought/flood/fire, loss of job, marriage, crop failure, death and other loss, b) an index of wedding gifts prevalent in the community of the household. These include house/flat, car, fridge, utensils etc. These indices are constructed by the same procedure as we do for physical and financial assets.

For an instrument to be valid, it must have good correlation with the endogenous asset variable and should not directly affect the loan decisions. We expect the index of major events to be negatively associated with physical assets because in case of any shock, households may have to cope up by depleting their asset base, i.e. selling some of their already owned assets. It is intuitive to assume that this is unlikely to influence lender's decision directly. Expenditures to cope up with such shocks may not lead to generation of income directly. Some types of shocks, for example, marriage may lead to generation of income indirectly via access to kinship resources (Heyer, 1989). The borrower may not reveal information about these events to the lenders and all types of lenders have some degree of imperfect information regarding the borrowers.

The index of wedding gifts may have a positive or a negative correlation with physical assets depending on whether the household is a net receiver or net giver of gifts. This is unlikely to affect lender's decision directly but only through physical assets. For example, if there is prevalence of gold as wedding gift and when a wedding occurs, there may be an increase in gold possession of the household or it may go down. It thus affects the holding position of physical assets of the household.

Instruments for financial assets

We use three IVs for financial assets: a) level of confidence the household has on the banking institutions to keep their money safe. It is a categorical variable with 0 denoting no confidence at all, 1 denoting some confidence and 2 indicating a good deal of confidence. The reference category is 0, b) an index of the major events experienced by the household in the last five years, c) an index of the benefits received from (or participation in) various social insurance schemes. It includes life insurance, health insurance, crop insurance, sanitary latrines or toilets,

Kisan credit card, Indira Awas Yojana and girl child registration scheme. We follow the same procedure to create these indices as we do for physical and financial assets.

Level of confidence in banks has been considered as an instrument because among all the components of financial asset index, bank savings constitute the largest, around 61% households reported having bank savings. It is obvious that the higher is the degree of confidence in banks, more likely people are to keep their money in banks. We thus expect a positive association. It is reasonable to assume that this instrument does not affect lending decision directly. If the household has confidence in the banking system they are more likely to have financial assets. These financial assets can be used to get credit. It is unlikely to affect the decision of lender in any other ways.

The index of benefits is expected to be positively correlated with financial assets because of the following reason. Participation in various schemes is reflected mainly in receipt of monetary benefits from the government or private agencies. This way some of the out of pocket expenditures of the household are substituted by these support. This should lead to increase in savings of the household leading to increase in financial assets. However, it is intuitive to argue that this instrument will not directly influence lender's decision only except via the stock of financial assets.

Index of major events may not directly affect decisions of the lenders, but it may be correlated with financial asset index because among all types of events, the highest experienced one is marriage (48.34% of households) and households may finance their marriages in many ways: borrowing or selling assets or in other ways which ultimately leads to a temporary change in liquid assets¹⁶.

3.4.4 IV estimation results

In table 3 above, we present the first stage regression results of the endogenous variables. As expected, physical asset index is negatively correlated with major event index($p < 0.01$). It has a positive and significant association with wedding gift index($p < 0.01$), which suggests that a given household receives more gifts than what it gives. The correlation of financial asset index with the three instruments is also as expected. We find positive and significant correlation between financial asset index and level of confidence in banking system($p < 0.01$) and with social

¹⁶Heyer (1989) finds that in South India marriage is the most important investment alternative to land, physical or financial assets. Access to kin relationship brings some form of insurance and other benefits.

benefits index($p < 0.01$). Similarly, major event index has a positive and significant association with financial assets($p < 0.01$), which indicates that on average, the household's financial asset base increases due to occurrence of any shock(s).

The bottom panel of table 3 provides the statistics regarding endogeneity of the asset variables. Financial asset index is endogenous in both selection and outcome models, evident from the significant correlation coefficients between error terms in these models and model of financial assets. However, physical asset index is endogenous in the outcome model only. It indicates that there is no problem of simultaneity or of omitted variables affecting both physical assets and probability of getting a loan in general.

Model 3 (in table 3) presents the results from IV estimation. Financial assets are positive and significant both in the outcome and in the selection models. It is to be noted that physical asset index is no longer significant in the selection model, though it has a negative coefficient. Thus, the instrumental variable estimation has been able to resolve the counter-intuitive estimate of physical assets. The insignificant coefficient of physical asset index together with the observed substitutability with land ownership in the selection model suggests that on average ownership of physical assets may not help in loan approval, but it does increase the chances of credit for the landless households. In the outcome model, both physical and financial assets are substitutable to land as before. Thus, while physical assets enable the landless to get a loan in general and to avail their largest loan from formal lenders, financial assets are more important to get the largest formal loan. This result is important because the landless in our case consists not only of the labourers and others but has a good fraction of the salaried class and the like, around 30%.

Related to the above point is that under the IV estimation, both the occupation categories, that is, salaried & others (group 1) and labourers & others (group 2) have significantly lower likelihood to get a loan in general, and also to obtain the largest formal loan relative to the cultivators and the allied($p < 0.01$). This suggests an interesting pattern of association between occupation type of borrowers and their credit access, which is basically centered on land ownership. As discussed in section 3.4 of this study, these two groups together constitute about of 97.07% of the landless households. The mean size of land ownership is around 2.66 acres for group 1 and 1.56 acres for group 2 which are far less as compared with the base group who own 13 acres of land, on average. Thus, even though land remains the primary asset that shapes lender's approval, other assets can be important for that matter.

In model 3, upper caste households not only have a lower probability of getting any loan in general, but also to avail the largest formal loan vis-à-vis the lower caste borrowers. Though this is

unexpected given our justification above, one likely reason could be the government subsidized credit programs targeted towards the socially disadvantaged groups (example, lower castes) of the society which may increase their credit access relative to the upper caste borrowers (Pender & Kerr, 1999). The results of other covariates are more or less preserved in the IV specification.

3.5 Conclusion

In light of the competing views regarding usefulness of land as collateral and the observation that landless borrowers also get loans, this study makes a novel attempt to understand whether other types of wealth, specifically ownership of physical and financial assets are substitutable to land in credit market. We also study if there is any association between wealth and purpose of loan, which represents the immediate and direct return from projects.

Using household level data for India, we arrive at some fresh findings. First, physical assets facilitate overall credit access for the landless households. In addition, when it comes to getting formal loan, physical assets are substitutable to land. Second, we find that financial assets are substitutable to land in order to get the largest formal loan. Further, we observe a complementary association between land and financial assets in the formal sector. Thus, financial instruments play a dual role: they enable the landless to get formal loan on one hand while also increase the likelihood of formal credit for the land rich borrowers. Third, our results suggest a complementary relationship between land and productive projects, that is, higher land ownership together with productive investments increase the chances of formal loan since they collectively provide better insurance to lenders. Fourth, we find an interesting pattern of association between occupation status of borrowers and their credit access, this relationship being centered on land ownership. Salaried class households, pensioners, professionals, organized business class, etc. have lower chances to get any loan, and particularly to get formal loan vis-à-vis the households engaged in cultivation and allied agriculture. Further, the labourer class and those involved in low income jobs are also less likely to get loan relative to the base group. One possible argument is that these two classes make up about 97.07% of the landless borrowers, and their average size of land ownership is much smaller than the cultivators and the allied. However, our results indicate that being landless need not necessarily be a constraint for these borrowers, since financial instruments and physical assets significantly increase their credit accessibility, especially in the formal credit sector.

Though our data does not provide information on whether the loans were backed by security

(which remains a limitation of our study), it can be easily understood why lenders would prefer wealthier borrowers even if no formal security is pledged (Feder et al., 1988; Herath, 1996). For example, Herath (1996) finds that both titled (landed) and untitled (landless) farmers took loans from informal sources without any collateral, but, the rate of interest was higher for untitled (85%) than that for titled farmers (70%). Nevertheless, we arrive at some new findings on the relationship among different forms of wealth in credit market, especially when it comes to credit access by the landless. To some extent, our study is able to explain why looking beyond land as collateral is important for households with limited immovable property so that they are not constrained by the availability of credit to undertake productive investments (Narayanan & Chakraborty, 2019). This may be possible because we find evidence of substitutability between land and the other assets. However, in line with previous studies like Feder et al. (1988), Mo-hieldin and Wright (2000), Carter and Olinto (2003), Dower and Potamites (2014), D. Pal and Laha (2015) and S. M. Kumar and Venkatachalam (2019) our study also re-establishes that land could be the dominant collateral because of its observed complementarity with financial instruments and with productive loan purpose. This raises a concern for the asset less/poor borrowers because it is most likely that ownership of land and other assets go hand in hand, so that their inclusion especially in the formal credit sector may be difficult to achieve.

Chapter 4

Friendship-kinship network and access to formal-informal credit in India

4.1 Introduction

Rationing of poor borrowers in the formal credit sector is often attributed to their inability to offer (sufficient) collateral (Bell et al., 1997). This leads them to resort to alternative sources of credit, such as moneylenders. The requirement of physical collateral is relatively less for moneylenders, and in some cases, they may even accept unconventional forms of collateral, if any. However, this risk of moneylenders is traded off against higher rates of interest charged by them (Tsai, 2004). Since 1950s, the Indian government has made numerous attempts to curb money lending activities by promoting expansion of credit-cooperatives, regional rural banks (RRBs) and non-banking financial companies, which was followed by nationalization of major commercial banks since 1969. Despite these efforts, borrowers continued to rely on usurious informal lenders, and the outreach of formal credit was quite limited. In light of these, microfinance programs were initiated during the 1980s to increase outreach of credit to poorer segments of the society (Ghatak, 1999; Ghatak & Guinnane, 1999; Parmeter, Sarangi, et al., 2020). Microfinance institutions (MFIs) disburse credit to poor with the support from a variety of intermediaries including commercial banks, cooperatives, credit unions, specialized banks, post offices and retail chains. The rates of interest on MFI loans are lower than the rates charged by moneylenders but much higher than those charged by banks (Turvey & Kong, 2010). MFI loans are mostly made through the group lending programs and the element of peer-monitoring inherent in such organizations acts as substitute to physical collateral (Guérin, Roesch, Venkatasubramanian, & D'espallier, 2012; Meyer & Nagarajan, 2006). With these dis-

tinct characteristics, these can be referred to as three of the most dominant forms of market credit¹ in India.

In contrast to market loans, there could be non-market institutions (NMIs) which operate side by side to supplement market insurance (Arnott & Stiglitz, 1991). In context of credit market, one such institution is borrowing from friends and relatives which constitute an easily accessible form of credit for households. Such loans are made with limited collateral and with flexible terms and the rate of interest is almost zero (Turvey & Kong, 2010; Zeller, 2006). They represent a form of social network/capital of households and cater to credit needs of those who are rationed in the formal sector. The benefits from such networks have been widely discussed in the literature. From being a direct source of credit to borrowers (Fafchamps & Gubert, 2007; Kinnan & Townsend, 2012), friendship-kinship networks provide valuable information about different financial opportunities (Jiang et al., 2022; Okten & Osili, 2004; T. Zhang, Liu, & Liang, 2020; Y. Zhang et al., 2012), and also serves as monitoring and enforcement mechanism which reduces credit risk for other lenders (Sun et al., 2018; Venittelli, 2021; T. Zhang et al., 2020; Y. Zhang et al., 2012).

Despite the beneficial effects of friendship-kinship network, it is not without its own limitations (Karaivanov & Kessler, 2018; Lee & Persson, 2016; Muduli & Dash, 2019; Turvey & Kong, 2010). Lee and Persson (2016) suggest that a shadow cost is associated even though family loan is cheaper as compared to loans from banks, moneylenders and MFIs. Borrowers have to reciprocate through costly favours on one hand, and in case of default, the relationship is destroyed, on the other. Turvey and Kong (2010) come up with an important finding in case of China. They show that when trust between borrowers and their friendship-relative network is sufficiently high, then informal borrowing amongst them not only crowd out rural credit cooperatives, but also the registered micro-finance institutions (MFIs) which are designed for poor households in the rural and agricultural areas. As the existing studies suggest, households weigh the relative costs and benefits of borrowing from friends/relatives vis-a-vis other sources. For instance, Karaivanov and Kessler (2018) suggest that a trade-off is involved while making a choice between formal and informal credit. Informal loans (from friends or relatives) come with an advantage that these do not require collateral and are usually interest free. But, there is a cost associated with such loans. If the fear of losing social ties upon default is very high, borrowers may instead choose formal loan. In a similar and recent study, Muduli and Dash

¹We may term these as market loans as these involve a price, unlike loans from friends/relatives which are usually interest free loans.

(2019) examine the borrowing choices of Indian households between formal and informal credit. Using data from All India Debt and Investment Survey (AIDIS) of 2013, they show that the social cost of default determines borrowing choices. When borrowing for risky projects that are less likely to succeed, households would rather borrow from outside their network as the social costs of default are high. The authors argue that a higher social cost of default is associated with a less dependence on friends and relatives and is an indication of lower credit risk of these borrowers.

The common observation evident from these studies is that loans from friendship-kinship network may affect borrowers' participation in credit market. This is a matter of concern because the policies directed towards expansion of formal credit and micro-finance in India (and elsewhere) may be ineffective in areas where borrowers have a strong preference towards borrowing within their family and friend circle, rather than what has been commonly shown in the literature that informal borrowing of this sort is a result of spillover of demand from formal sector (Bell et al., 1997; Turvey & Kong, 2010). It is possible that such non-market institutions (NMIs) crowd out any beneficial (or harmful) market loans. Therefore, it is important to examine whether borrowing from FR network affects borrowing from formal and informal lenders².

Therefore, the present study makes an attempt to address the following questions. First, we examine whether households' friendship-relative network (FR network henceforth) affects their probability of application to the three of most dominant sources of credit, the bank, the moneylender and the microfinance institutions (MFIs) in the Indian context. We further examine whether conditional on application, FR network affects the probability of approval from these lenders. The contribution of our study is that we capture the FR network of borrowers with the help of a loan obtained from them. Rather than using the amount borrowed, we use the number of cases of borrowing from friends and relatives as a measure, since the former is a better indicator of dependence on FR network (Muduli & Dash, 2019). This definition of FR network serves a dual purpose. It not only indicates the mobilization of actual monetary resources in form of a loan from friends and/or relatives, but also represents a functional network, the strength and usefulness of this network³.

FR network may influence borrowing choices of households in the following manner. First, due

²Refer to section 4.3.5 and note 7 on the formal informal sector distinction adopted in our study.

³However, one must note that not having a loan from friends or relatives does not necessarily mean that a given household has no FR network to support them. But having a loan is a clear indication that this network is functional.

to collateral constraint, borrowers are rationed in the amount of credit demanded. In that case, if borrower gets a portion of his credit need from his FR network, his demand curve shifts down, reducing the total effective demand for credit. Thus, he may be able to borrow the remaining amount from say bank given the amount of collateral at his disposal. Second, availability of FR loan may generate additional demand for new investment opportunities which can trigger an increased demand for loan from other sectors. Further, when the project of the borrower fails and generates insufficient returns, he may use support from his FR network to repay the loan. FR network may also provide a borrower with useful financial information such as the appropriate branch to approach and how to approach, and with information that leads to easier and faster documentation during application to bank, in particular. In all these cases, we should observe a positive effect of FR loan on the probability of credit application to other sectors. On the other hand, if borrowers' credit requirements are satisfied by FR loan, then definitely there is no demand for credit from bank, moneylender or MFI, in which case we should observe lower application rates to other lenders. Other than application choices of borrowers, FR network may also affect the probability of approval by lenders. An active FR network may be a useful signal to lenders regarding a borrower's credit worthiness. For instance, if a friend of a borrower has had a good repayment history and he refers the borrower to the bank, it may provide a positive signal to the lender about the borrower's repayment capacity. In a similar manner, moneylenders and microfinance institutions may utilize FR network of households to monitor their activities and to enforce repayment, if required. We thus have the first hypothesis of our study as follows. If a loan from FR network reduces a household's probability of borrowing from other lenders, FR network substitutes market loan(s). However, if the probability of borrowing from bank, moneylender or MFI increases in presence of an active FR network, it is indicative of a complementarity association between them.

As the second important objective of this study, we explore different mechanisms through which FR network can affect the outcomes of our interest. Merely having a network may not translate itself to desirable outcomes, when this network works via other channels to influence a household's credit market participation. We consider different mechanisms that could be driving the observed association between FR loan and credit application and approval probabilities of borrower households, namely, collateral substitution channel, political economy channel and social expenditure channel. We show that these mechanisms have heterogeneous effects on credit access from bank, moneylender and MFIs. In India, land is considered to be the most dominant collateral and it is widely used for formal sector borrowing, in particular. This leads

to rationing of the poor, that is, the landless, the marginal and small land owners from the formal credit sector (Bell et al., 1997; Hoff & Stiglitz, 1990). While lack of (sufficient) collateral leads to quantity rationing of the poor, asymmetric information between lenders and borrowers can even discourage households with necessary collateral from applying to formal sector, leading to what is known as risk rationing (S. Boucher & Guirking, 2007; S. R. Boucher, Carter, & Guirking, 2008; Cheng, 2007; Turvey & Kong, 2010). This motivates us to address the question of whether FR network substitutes the need for physical collateral (land) for the resource poor households, or whether it complements land ownership in credit market. Since there is heterogeneity in actual land ownership of borrowers, we examine the nature of interaction between FR network and different categories of land ownership, which we explain in details in section 4.5. As a second mechanism, we examine whether political connections of borrowers influence the association between their FR network and their borrowing outcomes. In a democracy like India, there are instances of capture of public welfare programs by political elites (Acemoglu, 2006; Chatterjee & Pal, 2021). The eligibility and allocation decisions in case of various governmental schemes are made by local bodies and credit is one of those politically provided inputs (Banerjee & Munshi, 2004; Tsai, 2004; Y. Zhang et al., 2012). In contrast to friendship-relative network, political networks are viewed as powerful as they often shape economic outcomes. Therefore, we study if politically connected households are in a better position to utilize their FR networks in getting access to market loans (especially bank loans) vis-a-vis the households without political connections. We explore a third channel by which FR network may affect households' borrowing choices via social expenditures. A lender today can be a borrower tomorrow and vice-versa. This leads to reciprocal arrangements between borrowers and their friendship-relative network (Ferrara, 2003; Lee & Persson, 2016). These relationships are maintained by way of incurring expenditures (e.g., gifts and exchanges) on social ceremonies like marriages, festivals, etc. which is likely to change the wealth and asset portfolio of borrowers. As a consequence, social expenditures are likely to affect the likelihood of application to and approval from other lenders.

On a methodological front, we contribute to the literature on social network and credit access by modelling together the loan application decision of the households and the approval decision of the lenders using a Heckman sample selection model. In the first stage, we estimate the probability of application to bank, moneylender and MFIs (all in separate models) as a function of FR network (loan) and other variables. In the second stage, conditional on application, we estimate the probability of loan approval as a function of FR network and

other covariates. This method takes into consideration the sequential nature of credit access and takes care of any possible sample-selection bias that can arise if the pool of applicants and non-applicants differ significantly in their initial conditions. Second, we suspect that FR network is endogenous. Since having a loan from friends/relatives could be simultaneously determined along with borrowing from other credit sources, and since there could be reverse causality running from borrowing from other sources to borrowing from FR network, we take care of the possible endogeneity using suitable instruments for FR network. We discuss the econometric issues in details in the methodology section.

Using a nationally representative data for Indian households, this study provides fresh evidences on the relationship between FR network and access to formal and informal credit. Results show that households who have an active FR network have a significantly higher probability of applying to both formal (bank and MFI) and informal (moneylender) lenders. The possible arguments could be that with some credit from FR network, a household becomes eligible for loan(s) from other lenders given its available collateral or it could generate new credit demand in presence of business opportunities. However, we find that a loan from friends/relatives reduces the probability of getting a loan from bank, which is counter-intuitive. We further explore the pattern of FR loan use among the states of India and find that there are six states (Haryana, Meghalaya, Assam, Orissa, Madhya Pradesh and Karnataka) for which the coefficient of FR loan on bank loan approval is negative and significant. A plausible explanation is that in these states the availability of FR loan leads to higher demand for credit from banks relative to households without FR loan and a likely consequence is that a higher fraction of the loan proposals are rejected. It is also possible that a household borrows from its network after it is denied a bank loan, which may explain the negative coefficient. This study also finds evidence of various channels through which FR network affects borrowing choices of households in India. In case of the first channel, we find a complementary association between FR loan and the semi-medium and above land owning classes (owning more than 4.94 acres) in application to bank, moneylender and MFI credit relative to those households who own less than this threshold or who do not have an FR loan or both. This is consistent with the perceived importance of land as collateral among borrowers. One probable argument is that FR network alleviates risk rationing for resource rich households, or it may also reduce quantity rationing of borrowers. So far as credit approval is concerned, the results indicate that FR network significantly increases the likelihood of getting a loan from MFI for the landless and marginal land owners vis-a-vis the land rich households. Secondly, FR network is complementary to political network when

it comes to getting a loan from bank. We may argue that some of the networks, especially friendship can be formed through political connections, and in turn, these connections enable a borrower to obtain formal credit. We thus complement the existing literature that suggest a positive association between political connections and access to bank credit. This finding has important implications in India where political connections determine access to social schemes for the poor in many instances. Another important finding of this study is that FR network increases the likelihood of application to moneylender for those households who have a higher social spending, on average. A larger social spending is an indication that borrowers have to maintain a costly and/or a large network. Since moneylender credit is usually more expensive than bank or MFI loans, this complementarity could mean that such households use their costly network to borrow from moneylender. This suggests a limited coverage of bank and microfinance institutions. Overall, our study finds a beneficial effect of FR network on application to formal and informal lenders, and it is through various channels that this effect is evident. There is no evidence of crowding out, instead crowding in of market loans in the Indian context. To some extent, we complement previous studies that examine linkage between market and non-market insurance, albeit in a different setting, for instance, Arnott and Stiglitz(1991).

The rest of the chapter is structured as follows. In section 4.2, we present a brief overview of the existing literature. Section 4.3 discusses the methodology of our study (data, variables and empirical strategies). In section 4.4, we discuss the results from the model estimation. In section 4.5, we explore possible channels between FR network and credit outcomes. Section 4.6 concludes with a discussion of the results in the light of the findings from previous studies and its implications in the credit market.

4.2 Review of literature

There is a vast literature that emphasizes the importance of social capital (social networks) of borrowers in facilitating credit access in developing countries. Social connections formed on the basis of cultural proximity between borrowers and lenders have been shown to improve credit access and reduce default probabilities(Fisman, Paravisini, & Vig, 2017). Using data from an Indian bank, Fisman et al.(2017) define cultural proximity (in group lending) using information on religion and caste for loan officers and borrowers. A lender and a borrower belong to the same group when both are members of the same minority religion (Christian, Muslim, Sikh,

Parsi or Buddhist) or when they belong to the same majority religion (Hindu), both the lender and the borrower belong to the same official caste (General Caste, SC, ST or OBCs). They test two mechanisms by which cultural proximity may affect credit outcomes. According to the first channel, cultural ties mitigate asymmetric information between lenders and borrowers thereby reducing credit rationing. The second channel indicates that higher default rates can result when lenders have a tendency to lend more to same group (in-group) members. The findings of their study are consistent with the first channel, that is, cultural proximity increases the probability of credit access and the volume of credit obtained and is associated with lower collateral requirements and better repayment performance.

The importance of social connections of borrowers, particularly arising from their kinship and friendship network has been well documented in the literature. Most studies suggest the positive effects of such networks in improving credit access of constrained borrowers. The channels of this linkage can be multiple. While FR network may serve as a source of useful information regarding borrowing opportunities (for example the right place to borrow), it may also serve as a monitoring and enforcement mechanism which could assure potential lenders of timely repayment. A third channel is more direct in which FR network directly disburses credit to needy borrowers. We provide a brief discussion these channels, as suggested in the literature, below.

4.2.1 Social network as a source of financial information

Networks can affect access to credit by providing information about borrowing opportunities (Jiang et al., 2022; Okten & Osili, 2004; Y. Zhang et al., 2012). Okten and Osili (2004) investigate the role of family and community networks on individual's credit access in case of Indonesia. The individual's family network is proxied by the total number of economically active siblings in the household while its quality (flow of information) is measured by the frequency of visits among siblings. The community network is captured by a dummy indicating whether the individual has participated in the community meeting in the survey period. The study establishes the information-based explanation of networks, that is, community and family networks are significant determinants of knowing a new place to borrow, as well as for loan approval. Women benefit from participating in community networks more than men. There is no evidence that the rich benefit from community networks more than the poor. Zhang et al. (2012) arrive at a similar finding in case of China that having access to weak ties is a way of

getting new information about financial system. Using data for Chinese households, Jiang et al. (2022) examine whether social networks facilitate household's financial market participation and risky asset holding. They construct an index using principal component analysis (PCA) to capture various dimensions of social networks of households: number of siblings, job position, type of work unit, communist party membership, gift expenditure, and communication expenditure. Financial market participation is captured by a dummy indicating whether a household owns risky asset, and financial asset allocation is measured by the fraction of risky assets held out of total financial assets. A Probit and a Tobit specifications are used to estimate the two dependent variables, respectively. This study finds that a higher value of the social network index is associated with a significantly higher probability of a household's financial market participation and with the fraction of risky assets holding in both formal and informal financial markets. They find evidence of two channels, the information channel and the risk-sharing channel by which social networks influence a household's financial decisions.

4.2.2 Social network as a monitoring and enforcement mechanism

Networks, especially friendship-kinship network may act as a risk mitigating mechanism for other lenders (Sun et al., 2018; Venittelli, 2021; Y. Zhang et al., 2012). Zhang et al. (2012) suggest that having access to close (strong) ties serves as a risk mitigating mechanism which assures the lender of repayment while granting credit to borrowers. Sun et al. (2018) find in context of China that kinship network enables credit access from both informal and formal sectors. In case of informal loan, it works by way of substituting physical collateral with personalized collateral, for instance when a network member vouches for his kin (would be borrower). On the other hand, kinship network helps in accessing formal credit by improving information flow between a household and the formal lender as the latter is better able to evaluate and monitor borrowers via their networks. In a recent study, Venitteli (2021) examines whether there is a complementarity between participation in micro-finance institutions (MFIs) and moneylender credit in terms of observed rate of interest. Using data from rural Andhra Pradesh, this study finds that moneylenders offer lower interest rates to borrowers who are participants at group lending programs. This is because on one hand, MFI borrowers have high incentives to monitor one another and on the other hand MFIs requires borrowers to invest their credit in income generating activities which in turn reduces default risk for the moneylender.

4.2.3 Social network as a source of credit

The existing literature suggests that friendship-kinship network still remains a preferred source of credit for many borrowers, who are constrained in the formal credit sector, especially bank (Fafchamps & Gubert, 2007; Ferrara, 2003; Kinnan & Townsend, 2012; Lee & Persson, 2016). Kinnan and Townsend (2012) examine the relative importance of kinship network and financial system (bank) in smoothing consumption and investment due to income volatility for rural households in Thailand. They conclude that access to financial institution helps to smoothen consumption, which is facilitated through collateralized borrowing or by threatened loss of participation in the financial network. However, kinship network is helpful only for financing investments since these are too large to be collateralized with tangible assets. Fafchamps and Gubert (2007) examine the reason behind formation of risk sharing networks in rural Philippines and find that geographical proximity correlated with kinship network facilitates monitoring and enforcement among borrowers and this explains the existence of mutual insurance links among villagers. In contrast to previous studies, Lee and Persson (2016) highlight the negative role of social connections, especially that of family relations. Such relations are associated with shadow costs because of reciprocity involving costly favours at times, and in case of non-compliance the relationship is destroyed. Ferrara (2003) explains the importance of kinship network in coping with credit constraints in developing economies. She builds a theoretical model to show that the scope for social enforcement remains quite high in a dynastically linked network and this sustains cooperation and reciprocal arrangement among them. Using data for rural Ghana, she finds that as high as 67% of the total amount borrowed comes from kinsmen.

4.3 Data and methodology

We use data from the second round (2011-12) of India Human Development Survey (Desai et al., 2015). This is a nationally representative multi-topic survey of Indian households in 1503 villages and 971 urban neighbourhoods. After removing missing observations, we have 39,835 households for the analysis, out of the total sample size of 42,152 households. About 24.6% of the households applied for bank loan, and 21.8% of the total sample have been approved a bank loan. The corresponding application and approval rates are 18.8% and 15.3% for the moneylender, and 13.1% and 9.6% for the microfinance institutions (MFIs). About 26.2% of

the households in our sample have obtained a loan from their FR network. For generalisability of the results, we use a survey weighted estimation of the model.

4.3.1 Conceptual framework

Our empirical strategy involves estimation of both the demand side (application) and supply side (approval) of credit access. However, if we estimate the two models separately, the estimates may be biased if the sample selection process is endogenous. One possible source of selection bias arises if the pool of applicants and non-applicants are characteristically different⁴. Another source of bias may result from unobserved factors which are correlated with both the probability of application and the probability of approval. Hence, we employ a Probit model with sample selection which applies to when both dependent variables are binary (Van de Ven & Van Praag, 1981). It fits a maximum-likelihood probit model with sample selection. The first stage models the probability of loan application of the households on the vector of explanatory variables, called the selection model. In the second stage, conditional on application, we estimate the probability of approval as a function of the same vector of covariates, called the outcome model (Van de Ven & Van Praag, 1981). This method eliminates sample selection bias by estimating the Inverse Mill's ratio (IMR), which is based on the correlation between the error terms in the outcome and selection equations. The null hypothesis (H0) states that the error terms in the outcome and selection models are uncorrelated, $\rho = \text{corr}(e.\text{select}, e.\text{outcome}) = 0$. A significant correlation coefficient ρ suggests that the IMR is significant and indicates presence of selection bias in the model.

4.3.2 Regression specification

The baseline sample selection Probit model is specified as follows:

$$\text{applyloan}_i = \alpha_0 + \alpha_1 FRloan_i + \alpha_2 Z_i + \delta_{s,i} + \mu_{1i} \dots (1)$$

$$\text{accessloan}_i = \beta_0 + \beta_1 FRloan_i + \beta_2 X_i + \delta_{s,i} + \mu_{2i}, \forall \text{applyloan}_i = 1 \dots (2)$$

Here, *applyloan* is a dummy taking value 1 if the i^{th} household has applied for any loan, and zero otherwise, *accessloan* is a dummy which takes a value 1 for those applicants whose loan has been approved, and zero otherwise. *FRloan* is the main independent variable in our model which takes a value 1 if a household has obtained any loan from its friends or relatives,

⁴We show this in table 3 below.

and zero otherwise. Z and X denote the vector of covariates affecting the probability of application and approval respectively such that Z and X are not necessarily same. Here, μ_{1i} and μ_{2i} are residuals from the two models following a bi-variate standard normal distribution with correlation coefficient ρ . When $\rho \neq 0$, standard Probit techniques applied to the two models separately leads to biased estimates. $\delta_{s,i}$ captures the state fixed effects to account for any unobserved as well as time invariant variability (differences) across states.

4.3.3 The identification strategy

In sample selection models, the identification strategy requires that the selection model (vector Z) must include at least one variable (exclusion restriction) that does not appear in the outcome model (Heckman, 1977, 1979; Wooldridge, 2010). Since we have different types of lenders, it is likely that different variables may influence the probability of application to bank, moneylender and MFIs. For bank, we use shock dummy as the exclusion restriction (instrument). It takes a value of one for households that have experienced any shock, idiosyncratic or co-variant during the period preceding the survey, and zero otherwise. The idea is that the shock variable is likely to affect a household's probability of applying for a loan. However, it is unlikely to influence whether or not a lender will approve. This is intuitive because a borrower may not reveal information about these events to the lenders during application and all types of lenders have some degree of imperfect information regarding the borrowers.

For moneylender and MFI, we use shock dummy as one of the exclusion restrictions, because it may affect a household's probability of application, but is unlikely to affect the chances of approval for the same reason as mentioned above. However, we consider a second instrument each for moneylender and MFI that may affect application choices in addition to the shock variable. We use the occupation type of a household as the second identifying variable for application to moneylender. We argue that the occupation status is likely to influence a borrower's decision to apply for moneylender credit but is not likely to affect approval, because unlike for banks or for MFIs, occupation may not give any additional information to moneylenders regarding the borrower's repayment capacity as these lenders usually operate in close knit societies and have other means to gather relevant borrower information. Hence, we include occupation only in the selection model in case of moneylender. But for bank and MFIs, this variable appears in both the outcome and in the selection models.

Similarly, for MFI credit, we include a second instrument called membership index, which

we assume affects the application probability to MFIs but not whether a loan is approved. This index is constructed as follows. We sum up the responses for memberships held by any member in the household in mahila mandal, youth/sports/reading clubs, lions/rotary clubs, union/business/professional groups, self-help groups, credit/savings groups, cooperatives, political party and panchayats. Each one is a dummy taking a value 1 if the respondent reports being a member, and 0 if otherwise. Next, we divide the sum of the responses by the total number of available memberships. It thus gives a continuous measure ranging between 0 and 1. The reason behind choosing this instrument is that the greater the number of memberships held by a household member in various associations, the greater is the likelihood of forming self-help groups or cooperatives in order to get some form of support (loans). The MFIs generally disburse credit to borrowers through SHGs, cooperatives, credit unions etc.(Meyer & Nagarajan, 2006; Turvey & Kong, 2010; Zeller, 2006). However, being a member at such organizations does not guarantee that a loan will be approved. Thus, membership index is likely to affect the probability of application to MFIs but not approval from MFIs.

4.3.4 Endogeneity concerns

In our model, the explanatory variable FR loan is likely to be endogenous. One source of endogeneity arises from omitted variables or unobservable factors which simultaneously determine both the probability of taking loans from friends or relatives, and the probability that a household apply and get a loan from other lenders. Another possible source is that of reverse causality where having a loan from other lenders (bank, moneylender or MFI) may determine whether the household borrows from its FR network. For e.g., a household may have to borrow from its FR network if it cannot get a bank loan. To address these concerns, we augment the sample selection model with an instrumental variable (IV) framework. We use three instruments such that these have good correlation with the likelihood of having an FR loan but do not directly affect the probabilities of applying and accessing credit from the other sources.

One channel which can contribute to getting a loan from friendship-relative circle is marriage status. Marriage constitutes a form of non-market institution and is a way to get access to social insurance(Arnott & Stiglitz, 1991; Guérin et al., 2012; Heyer, 1989; Munshi, 2011). In a 1981-82 study of villages in Coimbatore district of Tamil Nadu, Heyer(1989) examines the investment and expenditure strategies of landless agricultural labourers. He finds that marriage is a way of getting access to kinship relationships which bring in some form of insurance for the

rural poor and it could be viewed as a change to the existing network of an individual. A second channel of building a strong FR network is the size of the household. A larger family size is likely to be associated with a larger network of friends and relatives which in turn leads to a greater availability of credit from them. Household size is likely to be an exogenous measure of FR network⁵. We consider a third instrument for FR loan, a dummy indicating households' participation in public meetings. It is a way of improving bonding among people and this adds to the existing FR network of borrowers, which may increase the chances of getting a loan from them⁶. We conjecture that these instruments are not likely to be directly correlated with a household's application and approval probabilities in case of bank, moneylender and MFIs, except via FR network. Following this, we augment the base model with an instrumental variable framework as follows:

$$applyloan_i = \alpha_0 + \alpha_1 FRloan_i + \alpha_2 Z_i + \delta_{s,i} + \mu_{1i} \dots (1)$$

$$accessloan_i = \beta_0 + \beta_1 FRloan_i + \beta_2 X_i + \delta_{s,i} + \mu_{2i}, \forall applyloan_i = 1 \dots (2)$$

$$FRloan_i = \gamma_0 + \gamma_1 hhsizes_i + \gamma_2 marriage_i + \gamma_3 publicmeeting_i + \gamma_4 W_i + \delta_{s,i} + \nu_i \dots (3)$$

Equation (3) is the reduced form model such that *FRloan* is regressed on the instruments and the vector of covariates captured by *W*. Here $W = X$ because we must include all exogenous variables from the outcome (main) model in the reduced form model of the endogenous variable. Since *FRloan* is a binary, we use a Probit model for the estimation. Here, ν_i is the error term in this model following a normal distribution. We note that since *FRloan* may be endogenous in both the outcome and selection models, the IV framework takes care of its endogeneity in each model, if any. $\delta_{s,i}$ denotes the state fixed effects. Hence, we have a null hypothesis (H0) for each of the selection model and the outcome model. The H0 states that the error term in the structural model (outcome or selection) is uncorrelated with the error term in the reduced form model of the endogenous FR network variable, that is, $\rho = corr(e.FRloan, e.select) = 0$ and $\rho = corr(e.FRloan, e.outcome) = 0$. Here, *e.FRloan*, *e.select* and *e.outcome* refer to error term in the model of FR loan, in the selection model and in the outcome model respectively. A significant ρ in a model indicates that FR loan is endogenous in that model. The endogeneity

⁵Okten and Osili (2004), Yuan and Xu (2015) and Sun et al. (2018) use a similar measure, the number of adult siblings in the household to capture social network. They suggest that it is unlikely to be correlated with credit access but is closely related to a household's social network.

⁶Okten and Osili(2004) find in their study that participation in public meetings is a way to build up community network.

statistics are reported in all the tables below in these notations.

4.3.5 Variables and descriptive statistics

Table 1 presents the definition of the variables used in this study along with their summary statistics. For the present study, formal credit sector consists of conventional banking and financial institutions, officially sanctioned microfinance programs as well as state-sponsored and NGO-led programs while informal sector shall refer to moneylenders⁷.

In table 2, we present the percentage distribution of households with respect to their total outstanding debt according to various credit sectors. This description is as per the report of the All India Debt and Investment Survey, 2019 conducted during the 77th round of NSS (National Sample Survey). It is evident from table 2 that households rely more on institutional (formal) credit sources than on informal credit, both across rural and urban regions. However, the fraction of borrowers using formal credit is relatively higher for urban areas than in rural areas ($87.1\% > 66.2\%$). As far as usage of informal credit is concerned, it is concentrated mostly in rural areas than in urban areas in India ($33.8\% > 12.9\%$).

As already discussed, there is a possibility of selection bias in our study, as the pool of applicants and non-applicants are likely to differ in case of each credit sector. To check if this is the case, we present the t-tests of means (of continuous covariates) and proportions (of dummy covariates) between the two groups for bank, moneylender and MFI in table 3 below. The statistics indicate that the applicant and non-applicant households differ significantly across almost all the observed covariates in case of each lender. This indicates that we have selection bias, and hence the use of sample selection model is appropriate.

⁷Microfinance institutions are sometimes referred to as semi-formal lenders as they cater to commercial and developmental or policy oriented goals. However, since these institutions are usually approved by some government agency or entity, we regard MFIs as a part of the formal sector (Tsai, 2004).

Table 1. Variables definition and summary statistics

Dependent variables	Definition	Proportion	Std. dev.		
any bank	dummy =1 if the HH has loan from bank, govt.program or other credit program; 0 otherwise	0.218	0.413		
apply bank	dummy =1 if the HH has applied for any loan from bank, govt.program or other credit program; 0 otherwise	0.246	0.431		
any mon	dummy =1 if the HH has any moneylender loan; 0 otherwise	0.153	0.360		
apply mon	dummy=1 if the HH has applied for any moneylender loan; 0 otherwise	0.188	0.391		
any MFI	dummy =1 if the HH has any micro finance loan, loan from community group, NGOs or SHGs; 0 otherwise	0.096	0.295		
apply MFI	dummy =1 if the HH has applied for any microfinance loan, loan from community group, NGOs or SHGs; 0 otherwise	0.131	0.337		
Independent variables (categorical)	Definition	Proportion	Std. dev		
anyFRloan	dummy=1 if the HH has any loan from friends/relatives; 0 otherwise	0.262	0.440		
finassetdummy	dummy =1 if the HH has invested in any financial asset like securities, fixed deposits, credit society or pension, LIC, etc.; 0 otherwise	0.284	0.451		
malehead	dummy=1 if the HH is headed by a male; 0 otherwise	0.858	0.349		
salaried/professional	category=1 if primary occupation of the HH is salaried job, profession, organized business, pension/rent etc.	0.262	0.440		
low income workers	category=2 if the HH is engaged in wage labour, artisans, petty shop owners etc.	0.484	0.500		
Hindu	dummy=1 if religion of the HH is Hinduism; 0 otherwise	0.820	0.384		
upper caste	dummy=1 if the HH is Brahmin/general caste; 0 otherwise	0.283	0.451		
urban	dummy=1 if the HH resides in urban area; 0 otherwise	0.344	0.475		
shock dummy	dummy=1 if the HH has experienced any idiosyncratic or covariant shock; 0 otherwise	0.484	0.500		
any marriage	dummy=1 if there is any marriage in the HH; 0 otherwise	0.316	0.465		
public meetings	dummy=1 if any member attends public meetings; 0 otherwise	0.293	0.455		
small & above	dummy=1 if HH owns more than 2.47 acres of land; 0 otherwise	0.309	0.462		
semi-med & above	dummy=1 if HH owns more than 4.94 acres of land; 0 otherwise	0.204	0.403		
political network	dummy=1 if any member has joined political party or if there is any panchayat member/official in the HH or close to the HH; 0 otherwise	0.298	0.458		
Independent variables (continuous)	Definition	Mean	Std. dev.	Min	Max
land ownership	volume of land ownership in acres	3.758	12.725	0	1200
phy asset index	index of physical assets possessed by the HH	-0.026	0.239	-0.402	1.103
fin asset index	index of financial assets possessed by the HH	0.257	0.242	0	1.260
age of head	age of the HH head in years	49.653	13.570	11	99
highest educ	highest level of education attained by any member in the HH	8.267	5.093	0	16
per capita consp exp	HH expenditure in per capita terms	26985.520	31281.400	180	1461484
HH size	size of the HH	4.860	2.313	1	33
membership index*	index of memberships held by any HH member in clubs, social, dev.groups, cooperatives, political parties, etc.	.073	.094	0	.928
logsocialexp	logarithm of social expenditures incurred by the HH	7.046	2.316	0	14.509

Notes: Table 1 presents definition and summary statistics of variables used in the study.*: explained in 4.3.3. Source: IHDS-2, 2011-12.

Table 2. Percentage distribution of amount of outstanding debt of HHs by different credit sectors

Credit agency	Rural (%)	Urban (%)
scheduled commercial bank	41.9	68.4
regional rural bank	5.7	1.3
co-operative society	4.6	2
co-operative bank	5.3	5
insurance companies	0.1	1.3
provident fund	0	0.1
employer	0.1	0.3
financial corporation/institution	1.9	3
NBFCs including MFIs	2	3.9
bank linked SHG/JLG	3.5	1
non-bank linked SHG/JLG	0.4	0.2
other institutional agencies	0.5	0.7
All institutional agencies	66.2	87.1
landlord	1.1	0.1
agricultural moneylender	6.3	0.3
professional moneylender	16.5	6.9
input supplier	0.3	0.1
relatives and friends	6.8	4.1
chit fund	0.2	0.3
market commission agent/traders	0.6	0.2
others	2	0.9
All non-institutional agencies	33.8	12.9
Total	100	100

Notes: This table displays the fraction of outstanding debt of households from different credit sectors.

Source: AIDIS, 2019.

Table 3. t-tests of means/proportions between applicants and non-applicants

Variables (Bank)	applicants	non-applicants	difference	Std. error
land ownership	7.350	2.584	4.766***	0.146
phy asset index	0.020	-0.040	0.060***	0.003
age of head	51.115	49.176	1.939***	0.157
highest educ	9.550	7.848	1.702***	0.059
per capita consp exp	33426.710	24880.370	8546.348***	361.272
any FR loan	0.283	0.256	0.028***	0.005
fin asset dummy	0.369	0.256	0.113***	0.005
male head	0.905	0.842	0.063***	0.004
Hindu	0.850	0.810	0.040***	0.004
upper caste	0.298	0.278	0.020***	0.005
urban	0.290	0.362	0.072***	0.005
Variables (Moneylender)	applicants	non-applicants	difference	Std. error
land ownership	4.071	3.686	0.386**	0.163
phy asset index	-0.074	-0.014	-0.060***	0.003
fin asset index	0.232	0.262	-0.030***	0.003
age of head	48.230	49.983	-1.753***	0.174
highest educ	7.036	8.552	-1.516***	0.065
per capita consp exp	25217.530	27395.170	-2177.640***	400.946
any FR loan	0.385	0.234	0.151***	0.006
male head	0.879	0.853	0.026***	0.004
Hindu	0.873	0.808	0.065***	0.004
upper caste	0.170	0.309	-0.139***	0.005
urban	0.260	0.364	-0.104***	0.006
Variables (MFI)	applicants	non-applicants	difference	Std. error
land ownership	3.737	3.761	-0.024	0.189
phy asset index	-0.025	-0.026	0.000	0.004
age of head	48.610	49.810	-1.200***	0.202
highest educ	8.288	8.264	0.024	0.076
per capita consp exp	27201.300	26953.090	248.210	465.119
any FR loan	0.302	0.256	0.046***	0.007
fin asset dummy	0.453	0.258	0.194***	0.007
male head	0.871	0.856	0.016***	0.005
Hindu	0.854	0.815	0.040***	0.005
upper caste	0.209	0.294	-0.085***	0.006
urban	0.321	0.348	-0.026***	0.007

Notes: This table presents the difference of means (of continuous covariates) and proportions (of dummy covariates) between the applicants and the non-applicants in case of bank, moneylender and MFI. ***, ** and * represent significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

4.4 Results

Bank credit

In table 4 we report the results of the Heckman probit model with sample selection for bank. Model 1 is the base specification which does not account for possible endogeneity of FR loan, while model 2 fits a selection model using instruments for FR loan. We include state fixed effects in all the models to account for any unobserved and time invariant differences across states. The null hypothesis (H_0) states that the error terms in the selection and outcome equations are not correlated, that is, $\rho = 0$. We note that since we specify robust standard errors in our model, a Wald test statistic of independent equations ($\rho = 0$) is reported. In the base specification, the significant correlation coefficient (ρ) between the error terms in the two equations indicates the presence of sample selection bias. Therefore, the use of selection model is appropriate. The exclusion restriction shock dummy is positive and significant ($p < 0.01$) suggesting that households who have been hit by a shock are more likely to apply for a bank loan.

We instrument FR loan with the household size, marriage status and participation in public meetings in specification 2. All the instruments have a positive and significant correlation with the endogenous network variable ($p < 0.01$). A Wald test of the exogeneity of the instrumented FR loan is reported ($\rho = 0$). The significant correlation coefficient ρ suggests that we reject the null hypothesis of exogeneity in both the outcome and in the selection models ($p < 0.05$ and $p < 0.01$ respectively). This indicates that there may be omitted variables or unobservable factors affecting the likelihood of having an FR loan and that of applying and getting bank loan simultaneously or there may be reverse causality going from the decision to apply for bank credit and the chances of getting it to having a loan from FR network.

Having a loan from friends or relatives significantly increases the probability of applying for a bank loan ($p < 0.01$). This holds when we instrument FR loan with household size, marriage status and participation in public meetings in specification 2. One probable argument could be that bank loan requires borrowers to pledge collateral. In that case, a borrower may not be eligible for a loan given the amount of collateral at his disposal. However, if he can get some amount of credit from his FR network, the total credit demand goes down and he may now become eligible for the remaining amount of loan from the bank. It is also possible that a borrower is encouraged to invest in new opportunities when credit from FR network is available

and this can further add to demand for loan from other sources. Moreover, FR network may provide a borrower with useful information, such as the appropriate place(lender) to borrow from and may even help with resources so that the borrower can repay the loan without going into default. These arguments could explain why households with an active FR network may be more confident to apply⁸. All the asset variables (land, physical and financial assets)⁹ are associated with a higher probability of application to bank, suggesting their perceived role as collateral among formal sector borrowers($p < 0.01$). The results are preserved in specification 2. Households whose head is a male are more likely to apply to bank ($p < 0.01$). Similarly, the more educated the members of a household are, more likely they are to apply for bank loan ($p < 0.01$). This is intuitive because educated borrowers are better acquainted with the documentation and other formalities associated with bank credit. Higher age of the household head increases the application probability only in specification 2 where we account for endogeneity of FR loan($p < 0.1$). The more aged an individual is, the more experienced he is in handling the loan application processes. Relative to households whose primary occupation is cultivation or allied agriculture, salaried and professionals and those engaged in low income jobs are less likely to apply to bank ($p < 0.01$). This may be due to priority sector lending of the government directed more towards the cultivator class. Religion and caste group belonging do not have any significant association with the probability of application to or approval by bank. Households residing in urban areas are less likely to apply to bank relative to rural dwellers ($p < 0.01$).

We now discuss the results of the outcome model. Having an loan from friends/relatives significantly reduces the likelihood of loan approval by bank ($p < 0.01$) in specification 1. This result is not changed with introduction of instrumental variables in the second specification. This is counter intuitive as to why a strong network of friends and/or relatives would lower formal credit access. One probable explanation is as follows. A borrower who has access to FR loan may demand a higher amount of market loan than those without FR loan due to reasons as explained above. However, the effect of FR loan on the probability of approval from bank

⁸Refer to section 5 for a detailed discussion on the arguments and probable channels.

⁹Physical asset index includes items like house, cycle, sewing machine, mixer/grinder, scooter, television, etc. 1 denotes presence and 0 denotes absence of an item in a given household. Considering the binary nature of the items, we first a construct tetrachoric correlation matrix of all the items and then run factor analysis on the matrices to construct the index. We adopt the same approach to construct financial asset index. It includes investments made by the household in mutual funds/shares/bonds, expansion in house or property, fixed deposits, bank savings or current account, chit fund/SHG/credit society account, post office account and gold & jewellery.

Table 4. Effect of FR network on access to bank credit

Bank	Heckprobit		Heckprobit		FR loan
	(base model)		(IV estimation)		(reduced form)
Variables	outcome	selection	outcome	selection	
anyFRloan	-0.1744*** (0.0469)	0.0665*** (0.0212)	-0.6150*** (0.2030)	0.6851*** (0.1071)	
landownacre	0.0193** (0.0090)	0.0538*** (0.0035)	0.0184** (0.0088)	0.0530*** (0.0035)	-0.0072 (0.0043)
phyassetindex	0.0437 (0.0821)	0.2588*** (0.0368)	-0.0209 (0.0815)	0.3529*** (0.0353)	-0.6832*** (0.1099)
finassetdummy	0.0759 (0.0538)	0.1520*** (0.0275)	0.0715 (0.0557)	0.1520*** (0.0307)	-0.0507 (0.0382)
malehead	-0.0339 (0.0552)	0.3129*** (0.0334)	-0.0306 (0.0542)	0.2980*** (0.0319)	-0.0354 (0.0268)
age of head	-0.0012 (0.0017)	0.0011 (0.0008)	-0.0017 (0.0018)	0.0019** (0.0009)	-0.0066*** (0.0006)
highest educ	0.0029 (0.0042)	0.0317*** (0.0023)	0.0026 (0.0039)	0.0308*** (0.0022)	-0.0070* (0.0040)
salaried/professional	0.0869 (0.0753)	-0.2322*** (0.0290)	0.0658 (0.0732)	-0.1976*** (0.0272)	-0.1390** (0.0549)
low income workers	-0.0384 (0.0572)	-0.2370*** (0.0202)	-0.0365 (0.0534)	-0.2317*** (0.0220)	0.0172 (0.0355)
percapita consp exp	0.0000 (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)
Hindu	0.0525 (0.0499)	0.0336 (0.0280)	0.0558 (0.0478)	0.0261 (0.0258)	0.0620 (0.0531)
uppercaste	0.0517 (0.0477)	-0.0094 (0.0261)	0.0431 (0.0469)	0.0033 (0.0229)	-0.0357 (0.0318)
urban	0.0147 (0.0452)	-0.1436*** (0.0318)	0.0093 (0.0438)	-0.1346*** (0.0307)	0.0230 (0.0276)
shock dummy		0.1262*** (0.0197)		0.1179*** (0.0184)	
HH size					0.0416*** (0.0036)
any marriage					0.2297*** (0.0259)
public meetings					0.1785*** (0.0302)

may depend on the extent of the demand. If the demand for loan is within certain limit or the lending capacity of the bank, it may be approved. But, if the household's demand is very high, it could lower the chances of approval. To check whether this is indeed the case, we carry out a deeper analysis of the pattern of FR loan use among the states of India through an interaction of FR loan with state fixed effects (state ids) in the appendix (Table 10). As we can see, the individual coefficient of FR loan on the probability of obtaining bank loan is now insignificant. Further, the table reveals that there are six states (Haryana, Meghalaya, Assam, Orissa, Madhya Pradesh and Karnataka) for which the interaction effect on bank loan approval

Table 4. Effect of FR network on access to bank credit (continued)

Bank	Heckprobit (base model)		Heckprobit (IV estimation)		FR loan (reduced form)
	outcome	selection	outcome	selection	
State fixed effects	yes	yes	yes	yes	yes
constant	1.9514*** (0.1532)	-1.7619*** (0.0970)	2.1115*** (0.1673)	-1.9693*** (0.1145)	-0.3180*** (0.1145)
corr(e.select,e.outcome)	-0.9094*** (0.0416)		-0.9122*** (0.0365)		
corr(e.FR,e.outcome)					0.2581** (0.1093)
corr(e.FR,e.select)					-0.3659*** (0.0652)

Notes: This table presents the results of sample selection Probit model without endogeneity (specification 1) and with endogeneity (specification 2). Selection model and outcome model give the coefficients of FR loan on the probability of application to and approval from bank respectively. Reduced form model shows that FR loan is regressed on the instruments and other covariates. For specification 1, H0: Wald test of indep. eqns. ($\rho = 0$). For specification 2, H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$). Robust standard errors in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

is negative and significant. It is positive and significant for five states (Chandigarh, Sikkim, Arunachal Pradesh, Manipur, Dadra and Nagar Haveli) and insignificant for the remaining states. The negative effect of FR network arising from the six states dominates any positive effect, and thus the net effect of FR network on formal credit access is negative. Thus, in case of the six states, households with FR loan may have higher credit demands relative to those without FR loan, which makes it more likely that their chances of getting bank credit goes down vis-a-vis those without FR loan.

Yet, another way of interpreting this result could be as follows. It is possible that a household could not get a bank loan and thus borrow from its FR network to meet its credit demand. In such a case whenever a household obtains a loan from its network, it implies that it is rationed by bank and this leads to a negative coefficient of FR loan in the outcome model. This suggests reverse causality between the probability of borrowing from FR network and from the bank. This possibility makes us more pertinent to consider FR network as endogenous. This is further reinforced by a significant endogeneity of FR loan in the outcome equation in table 4. We note that this explanation holds for any negative coefficient of FR loan evident from subsequent analysis. Among the asset variables, only amount of land ownership increases the chances of getting a bank loan ($p < 0.05$) which is consistent with previous studies that land is a dominant collateral in the formal credit sector. Age, education, gender of the household head, occupation status, religion and caste all are insignificant in getting access to bank credit.

Moneylender credit

Table 5 presents the estimates of the sample selection model for moneylender. Model 1 is the base specification while model 2 accounts for possible endogeneity of FR loan. The null hypothesis (H_0) is that the error terms in the selection and outcome equations are uncorrelated ($\rho = 0$). As we specify robust standard errors in our model, a Wald test statistic of independent equations ($\rho = 0$) is reported. We have sample selection bias, as evident from the significant correlation coefficient between the error terms in the outcome and selection models in both the specifications. In model 1, both the exclusion restrictions have significant coefficients. The shock dummy is positive and significant ($p < 0.01$) suggesting that households who have been hit by a shock are more likely to apply for moneylender loan. So far as the occupation status is concerned, salaried class/professionals are less likely to apply to moneylender while low income class are more likely to apply relative to households engaged in agriculture and allied occupations. However, the coefficient is significant only for the salaried/professional group ($p < 0.05$). This holds in specification 2 where we account for endogeneity of FR loan. The reduced form model suggest that FR network has positive and significant correlation with all three instruments ($p < 0.01$). The output reports a Wald test of the exogeneity of the instrumented FR network dummy. FR loan is endogenous in the selection model as the significant correlation coefficients (ρ) between the error terms in the selection equation and that in FR loan model suggest ($p < 0.01$). It may point towards the presence of unobservable factors simultaneously affecting the probabilities of applying for moneylender credit and of having an FR loan, or there may be the problem of reverse causality¹⁰.

¹⁰FR loan is not significantly endogenous in the outcome model. One probable argument is that there is a smaller variability among the applicants in the approval stage, that is, about 81.38% of the applicants get moneylender credit.

Table 5. Effect of FR network on access to moneylender credit

Moneylender	Heckprobit		Heckprobit		FR loan
	(base model)		(IV estimation)		(reduced form)
Variables	outcome	selection	outcome	selection	
any FR loan	-0.1757** (0.0781)	0.1670*** (0.0464)	-0.2197 (0.1618)	0.6587*** (0.0708)	
landownacre	-0.0055*** (0.0012)	-0.0004 (0.0008)	-0.0056*** (0.0012)	-0.0004 (0.0009)	-0.0017 (0.0011)
phyassetindex	-0.5650*** (0.1218)	-0.3459*** (0.0983)	-0.5947*** (0.1342)	-0.2433*** (0.0897)	-0.7183*** (0.0769)
finassetindex	0.3146*** (0.1153)	0.1433** (0.0716)	0.3281*** (0.1165)	0.1162 (0.0721)	0.0751 (0.0564)
malehead	0.0008 (0.0393)	0.1635*** (0.0385)	0.0044 (0.0405)	0.1534*** (0.0370)	-0.0202 (0.0250)
age of head	-0.0002 (0.0017)	-0.0039*** (0.0008)	-0.0004 (0.0018)	-0.0031*** (0.0007)	-0.0070*** (0.0006)
highest educ	-0.0062 (0.0047)	-0.0176*** (0.0027)	-0.0066 (0.0048)	-0.0164*** (0.0026)	-0.0109*** (0.0041)
percapita consp exp	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000*** (0.0000)
Hindu	-0.0314 (0.0727)	0.1105** (0.0450)	-0.0294 (0.0734)	0.1059** (0.0410)	0.0583 (0.0531)
uppercaste	-0.0209 (0.0585)	-0.1201*** (0.0368)	-0.0266 (0.0581)	-0.1055*** (0.0359)	-0.0573* (0.0296)
urban	0.0375 (0.0724)	-0.0961*** (0.0321)	0.0350 (0.0728)	-0.0867*** (0.0319)	0.0046 (0.0251)
shock dummy		0.2309*** (0.0376)		0.2228*** (0.0371)	
salaried/professional		-0.1472** (0.0580)		-0.1405** (0.0579)	
low income workers		0.0442 (0.0313)		0.0443 (0.0309)	
HH size					0.0427*** (0.0041)
any marriage					0.2338*** (0.0239)
public meetings					0.1588*** (0.0279)

In case of the base model, FR loan significantly increases the probability of applying for moneylender credit. When we address the possible endogeneity of this variable, it is still significant and positive with an increase in the magnitude of the coefficient ($p < 0.01$). This could suggest that having a strong network of friends and relatives (as captured by a loan obtained from them) increases a household's confidence in applying to moneylender. We provide a detailed justification for the possible channels in section 5 below. In both the specifications, the index of physical assets has a negative and significant coefficient ($p < 0.01$). It could be because households owning more physical assets are relatively wealthier and hence may resort to formal

Table 5. Effect of FR network on access to moneylender credit (continued)

Moneylender	Heckprobit (base model)		Heckprobit (IV estimation)		FR loan
	outcome	selection	outcome	selection	(reduced form)
State fixed effects	yes	yes	yes	yes	yes
constant	1.9423*** (0.2428)	-1.6603*** (0.1502)	1.9481*** (0.2391)	-1.8370*** (0.1420)	-0.3322*** (0.0972)
corr(e.select,e.outcome)	-0.7918*** (0.0859)		-0.7638*** (0.0970)		
corr(e.FR,e.outcome)					0.0353 (0.0807)
corr(e.FR,e.select)					-0.2950*** (0.0443)

Notes: This table presents the results of sample selection Probit model without endogeneity (specification 1) and with endogeneity (specification 2). Selection model and outcome model give the coefficients of FR loan on the probability of application to and approval from moneylender respectively. Reduced form model shows that FR loan is regressed on the instruments and other covariates. For specification 1, H0: Wald test of indep. eqns. ($\rho = 0$). For specification 2, H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$). Robust standard errors in parentheses. ***, ** and * represent significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

sector if required. Financial asset is significant in the base model only and is insignificant when endogeneity of FR loan is taken care of. Households with a male head are more likely to apply to moneylender ($p < 0.01$). However, higher age of the head and higher levels of education lowers the probability of application ($p < 0.01$). Hindu households are more likely to apply while upper caste households are less likely to apply to moneylender ($p < 0.05$ and $p < 0.01$ respectively). Households who belong to urban areas are less likely to apply to moneylender relative to the rural households ($p < 0.01$). This makes sense because moneylenders mostly operate in rural areas. These results hold in specification 2.

We now discuss the results of the outcome model. In the base model, having an existing loan from friends/relatives significantly lowers the chances of getting moneylender credit, but is not significant when we account for its possible endogeneity in specification 2. One may argue that a strong networks of borrowers may make it easy for moneylender to monitor them and enforce repayment, but the results suggest that FR network by itself does not serve this purpose. One possible justification behind this insignificant result is that as high as 81.38% of all households that applied for moneylender credit were approved, suggesting lower variability in the data in the approval stage. As a test of robustness, we explore different possible channels in section 4.5 that may explain the insignificant coefficient. Among the asset variables, land ownership and physical assets reduce the probability of getting a moneylender loan ($p < 0.01$)

while financial assets increases this probability ($p < 0.01$). This is true across both the models. Other variables do not significantly affect the probability of obtaining credit from moneylender.

MFI credit

In table 6, we report the estimates of application and approval probabilities for MFI credit. We estimate two models, the first model estimates a sample selection Probit model while the second specification augments this with an instrumental variable framework to address any endogeneity of FR network. The null hypothesis (H_0) states that the error terms in the selection and outcome equations are uncorrelated ($\rho = 0$). Since we consider robust standard errors, a Wald test statistic of independent equations ($\rho = 0$) is reported in the model output. The significant correlation statistics indicates the presence of selection bias, across both the specifications. Both the exclusion restrictions have significant and positive correlation with the likelihood of application to MFIs ($p < 0.01$). The coefficient of shock dummy indicates that households who have been hit by a shock are more likely to apply for a microfinance loan. Similarly, the more the number of memberships held by the household, more likely it is to apply for MFI credit relative to those having no or fewer engagements. The signs of the exclusion restrictions are as expected. The regression output reports a Wald test of the exogeneity of the instrumented FR network variable. The significant correlation parameter (ρ) suggests that FR loan is endogenous in the selection model but is not endogenous in the outcome model. FR loan is not significant in the base model, but is positively and significantly correlated with the likelihood of application to MFI ($p < 0.01$) when endogeneity of the network variable is taken care of. A probable argument for this is that MFIs operate on the concept of peer-monitoring and risk-sharing. It is likely that borrowers who form a group to avail MFI credit are known to each other, preferably people from their FR network. As Zeller (2006) mentions, the lender today may be a borrower tomorrow and this reciprocity sustains the relationship. Further, the threat of social sanctions upon default disciplines borrowers to invest their loan productively. All these are likely to facilitate monitoring and enforcement for the MFIs (Zeller, 2006). In section 5, we discuss on different mechanisms by which FR network may affect credit participation of borrowers.

However, FR network is not significant in getting approval from MFIs (outcome model). The insignificant coefficient could be due to a smaller variation in the approval stage as 73.28% of

Table 6. Effect of FR network on access to MFI credit

MFI	Heckprobit (base model)		Heckprobit (IV estimation)		FR loan (reduced form)
Variables	outcome	selection	outcome	selection	
any FR loan	-0.2107*** (0.0507)	0.0345 (0.0273)	0.1899 (0.3038)	0.6939*** (0.1761)	
landownacre	-0.0037* (0.0021)	0.0003 (0.0009)	-0.0037* (0.0021)	0.0004 (0.0009)	-0.0014* (0.0008)
phyassetindex	-0.2670* (0.1492)	-0.3408*** (0.0754)	-0.2315 (0.1591)	-0.2342*** (0.0807)	-0.6686*** (0.0667)
finassetdummy	0.3290*** (0.0741)	0.4045*** (0.0266)	0.3253*** (0.0737)	0.3980*** (0.0268)	-0.0412* (0.0242)
malehead	0.0923 (0.0671)	0.0398 (0.0358)	0.0927 (0.0653)	0.0337 (0.0351)	-0.0357 (0.0293)
age of head	-0.0045** (0.0019)	-0.0050*** (0.0009)	-0.0039** (0.0019)	-0.0040*** (0.0009)	-0.0067*** (0.0008)
highest educ	0.0050 (0.0054)	-0.0018 (0.0027)	0.0050 (0.0054)	-0.0013 (0.0026)	-0.0068*** (0.0023)
salaried/professional	-0.0351 (0.0844)	-0.0670 (0.0435)	-0.0184 (0.0843)	-0.0362 (0.0436)	-0.1446*** (0.0336)
low income workers	0.0396 (0.0649)	0.0976*** (0.0337)	0.0336 (0.0639)	0.0910*** (0.0330)	0.0301 (0.0275)
percapita consp exp	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000*** (0.0000)
Hindu	-0.0323 (0.0612)	0.0373 (0.0330)	-0.0380 (0.0604)	0.0303 (0.0320)	0.0617** (0.0264)
uppercaste	0.0323 (0.0559)	-0.0440 (0.0305)	0.0305 (0.0548)	-0.0325 (0.0300)	-0.0467* (0.0256)
urban	0.1125** (0.0552)	-0.0703** (0.0291)	0.1226** (0.0542)	-0.0629** (0.0284)	0.0291 (0.0237)
shock dummy		0.1050*** (0.0239)		0.0976*** (0.0231)	
membership index		2.1792*** (0.1245)		2.0881*** (0.1250)	
HH size					0.0409*** (0.0045)
any marriage					0.2159*** (0.0213)
public meetings					0.1645*** (0.0247)

the MFI applicants get a loan. Among the wealth variables, financial asset dummy is significant in both outcome and selection models, and across both the specifications. Households who have invested in any financial asset are not only more likely to apply for MFI credit, but have higher chances of approval vis-a-vis those without these assets ($p < 0.01$). Households whose head is a male are more likely to apply for MFI credit ($p < 0.1$) though it is not significant for approval.

The more aged the head is, less likely the household is to apply for MFI loan. This holds across

Table 6. Effect of FR network on access to MFI credit(continued)

MFI	Heckprobit (base model)		Heckprobit (IV estimation)		FR loan
	outcome	selection	outcome	selection	(reduced form)
State fixed effects	yes	yes	yes	yes	yes
constant	1.8347*** (0.3004)	-1.7879*** (0.1286)	1.7136*** (0.3597)	-1.9934*** (0.1298)	-0.3317*** (0.0886)
corr(e.select,e.outcome)	-0.7504*** (0.0682)		-0.6912*** (0.0907)		
corr(e.FR, e.outcome)					-0.2054 (0.1793)
corr(e.FR, e.select)					-0.3825*** (0.0980)

Notes: This table presents the results of sample selection Probit model without endogeneity (specification 1) and with endogeneity (specification 2). Selection model and outcome model give the estimates of effect of FR loan on the probability of application to and approval from MFI respectively. Reduced form model shows that FR loan is regressed on the instruments and other covariates. For specification 1, H0: Wald test of indep. eqns. ($\rho = 0$). For specification 2, H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$). Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

both the specifications ($p < 0.01$ and $p < 0.05$ respectively). However, age is not a significant determinant of MFI credit access. Education level of the household is also not significant for application to and approval by MFIs. So far as occupation status is concerned, it is positive and significant only for application decision and for the low income class only. This group is more likely to apply for MFI loan ($p < 0.05$) relative to the base group (cultivation and allied agriculture). We do not find any significant evidence that religion or caste is associated with application to and approval for MFI credit. Urban households are more likely to get MFI loan relative to the rural households ($p < 0.1$).

4.5 Channels between FR network and credit access

The results so far provide a mixed evidence on the role of FR network on the probability of credit application and approval of households across different lenders: bank, moneylender and microfinance institutions. We find that the coefficient of FR loan is insignificant in some of the specifications. These inconsistencies lead us to explore various channels that could drive the observed association between FR network and credit access of borrowers. This is important because loans from friends or relatives may be effective for a certain segment of borrower households relative to others while discussing the outcomes of interest.

Direct channel

The first channel is direct where having a loan from friends or relatives may satisfy the credit needs of borrowers, partially or completely, which can affect further applications to other lenders. Two possibilities may arise when loans from FR network partially satisfy credit requirement of borrowers. First, a borrower has a fixed demand for credit and assume that with his available collateral, he was not able to get a bank loan. But, if he gets a fraction of his credit demand from his relatives or friends, he may now become eligible for a bank loan. This is because a lender hardly satisfies cent percent of total household demand for credit (Bell et al., 1997; Hoff & Stiglitz, 1990). Second, some studies have pointed out that when there is rationing in the market, availability of a second credit source may generate additional demand when there are scope for new business opportunities (Demont, 2016; Islam et al., 2015). Thus, in our case, availability of FR loan may increase credit demand of borrowers from other sources, indicating an increase in the application probabilities.

Other arguments that may explain a higher probability of application are as follows. When the project yield is uncertain, a household may use support from its FR network to repay and this may increase its likelihood of application to other lenders. In addition, friends and relatives can provide a borrower with information that may be useful to approach the appropriate institution(s). In all these cases, we should observe a positive effect of FR loan on the probability of credit application to other sectors. On the other hand, if borrowers' credit demand are satisfied by FR loan, then there is no demand for credit from bank, moneylender or MFI. This channel is self-explanatory if we find evidence of a negative and significant coefficient of FR loan on the probability of application. Results (tables 4, 5 and 6) show that FR loan has a positive and significant effect ($p < 0.01$) on the likelihood of application in case of all lenders. This suggests a direct effect in which households' credit demand has been partially met from their FR network and thus they have a tendency to apply to other lenders for the remaining credit. However, since there could be other factors affecting the relationship between FR network and credit outcomes as explained earlier, we explore different indirect channels below.

Collateral substitution channel

The literature suggests that asset poor households who lack sufficient collateral to offer against a loan are involuntarily excluded from the credit market (quantity rationing) and thus cannot undertake profitable projects (S. Boucher & Guirkingner, 2007; S. R. Boucher et al., 2008). In the extreme situation, borrowers might be discouraged from borrowing even when they have

the necessary collateral to qualify for a loan, which occurs due to lack of an insurance market and asymmetric information of the lenders increase the contractual risks for the borrowers (risk rationing) (S. R. Boucher et al., 2008; Cheng, 2007; Turvey & Kong, 2010). This leads us to explore the second mechanism through which FR loan may affect credit market outcomes. Land as a collateral is heavily employed by banks in developing economies as a screening and monitoring mechanism (Hoff & Stiglitz, 1990). India is not an exception to this. Given the widespread use of land collateral here, we examine if FR network increases credit application and access of land poor households vis-a-vis land rich households. If FR network increases the probability of loan application for the resource poor households, we can say that it substitutes the need of collateral in credit market, in other words reduces quantity rationing. However, if it increases the probability of credit application (or approval) for the land rich households vis-a-vis the poor, then FR loan (network) complements land ownership. This will mean that FR loan facilitates the use of collateral for resource rich households because it is likely to reduce the risk of forgoing their collateral (land) in case of default, as some form of support or insurance, thus reducing risk rationing. For risk-rationed borrowers, having a loan from friends and/or relatives may increase their confidence that they have some form of support (either the network itself or the loan) and increase their probability of application. The other argument follows from the points made in case of direct channel, which is that borrowers with an FR loan may increase their credit demand from other lenders. To test this channel, we interact the FR network dummy with two different landowning class, the small and above group (households owning more than 2.47 acres of land) and the semi-medium and above group (households owning more than 4.94 acres of land), in separate models.

In Table 7a and 7b, we examine whether FR network of households substitutes the need for collateral while borrowing from other credit sources. We interact FR loan with different categories of land ownership, following the report of the Ministry of Agriculture and Farmers Welfare, Government of India.

In table 7a, we interact FR loan with the dummy small and above, which takes a value 1 for households owning more than 2.47 acres of land. We consider a second specification in table 7b where FR loan is interacted with the dummy semi-medium and above, which is equal to 1 for households owning more than 4.94 acres. We estimate a sample selection model with an IV framework that incorporates endogeneity of FR loan in case of all lenders. The positive and significant coefficient of the small & above dummy in case of bank credit indicates that land rich households are not only more likely to apply for a bank loan ($p < 0.05$), but also have a higher

Table 7a. FR network and access to credit: the collateral channel

Variables	Bank		Moneylender		MFI	
	outcome	selection	outcome	selection	outcome	selection
any FR loan	-0.5919*** (0.2125)	0.6093*** (0.1538)	-0.2000 (0.1487)	0.5900*** (0.0727)	0.2563 (0.3013)	0.6524*** (0.1802)
small & above	0.1909** (0.0782)	0.4088*** (0.0296)	-0.1216** (0.0495)	-0.0748 (0.0481)	-0.0582 (0.0754)	-0.0810** (0.0407)
phy asset	-0.0313 (0.0946)	0.3614*** (0.0366)	-0.5885*** (0.1362)	-0.2461*** (0.0907)	-0.2448 (0.1598)	-0.2300*** (0.0816)
fin asset	0.0940 (0.0650)	0.1513*** (0.0299)	0.3089*** (0.1162)	0.1155 (0.0715)	0.3219*** (0.0723)	0.3975*** (0.0269)
male head	-0.0088 (0.0548)	0.2993*** (0.0342)	-0.0023 (0.0404)	0.1537*** (0.0380)	0.0965 (0.0658)	0.0357 (0.0352)
age of head	-0.0017 (0.0020)	0.0022** (0.0009)	-0.0001 (0.0017)	-0.0031*** (0.0007)	-0.0041** (0.0019)	-0.0039*** (0.0009)
highest educ	0.0054 (0.0049)	0.0312*** (0.0022)	-0.0052 (0.0048)	-0.0163*** (0.0027)	0.0053 (0.0054)	-0.0009 (0.0026)
pc consp exp	0.0000 (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Hindu	0.0586 (0.0516)	0.0239 (0.0259)	-0.0172 (0.0700)	0.1033** (0.0410)	-0.0232 (0.0611)	0.0284 (0.0320)
uppercaste	0.0398 (0.0506)	0.0070 (0.0240)	-0.0135 (0.0588)	-0.1089*** (0.0361)	0.0371 (0.0552)	-0.0322 (0.0300)
urban	0.0018 (0.0498)	-0.1321*** (0.0303)	0.0199 (0.0718)	-0.0881*** (0.0295)	0.1085* (0.0563)	-0.0725** (0.0289)
salaried/professional	0.0801 (0.0787)	-0.2094*** (0.0266)		-0.1552** (0.0600)	-0.0614 (0.0903)	-0.0586 (0.0470)
low income workers	-0.0343 (0.0614)	-0.2355*** (0.0235)		0.0284 (0.0296)	-0.0126 (0.0686)	0.0683* (0.0369)
shock dummy		0.1266*** (0.0197)		0.2235*** (0.0360)		0.1006*** (0.0233)
membership index						2.1004*** (0.1248)
FRloan*small & above	-0.0118 (0.1228)	0.1082 (0.0685)	-0.0673 (0.0741)	0.1593*** (0.0427)	-0.2116** (0.1056)	0.1389** (0.0569)
State fixed effects	yes	yes	yes	yes	yes	yes
constant	2.0126*** (0.1901)	-2.0071*** (0.1241)	2.0451*** (0.2068)	-1.8007*** (0.1341)	1.7861*** (0.3583)	-1.9612*** (0.1327)
corr(e.select,e.outcome)		-0.8446*** (0.0751)		-0.8010*** (0.0931)		-0.6916*** (0.0880)
corr(e.FRloan,e.select)		-0.3459*** (0.0822)		-0.2840*** (0.0443)		-0.3827*** (0.0982)
corr(e.FRloan,e.outcome)	0.2451** (0.1131)		0.0354 (0.0781)		-0.2038 (0.1773)	

Notes: This table presents the estimates of the collateral channel through an interaction of FR loan with small & above land ownership dummy for each lender. An endogenous sample selection Probit model is estimated. H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$).

Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

likelihood of getting the loan relative to the landless and marginal land owners ($p < 0.05$). This result is consistent with the importance of land as collateral in formal credit sector. However, higher ownership of land is not significant while applying to moneylender but when it comes to approval, the small & above category has a lower probability of approval than the base group ($p < 0.05$). On the other hand, in case of MFI credit, the land rich households are less likely to apply to microfinance institutions vis-a-vis the landless and the marginal land owners ($p < 0.05$). But, land ownership is not a significant determinant of MFI loan approval. Having an active FR network increases a household's probability of application to all other lenders ($p < 0.01$). But, in case of approval from bank, these borrowers are less likely to get a loan relative to borrowers without an FR network (loan) ($p < 0.01$).

We now focus on the interaction effects. Households that have an FR loan and own more than 2.47 acres of land (small & above category) have a significantly higher probability of applying to moneylender ($p < 0.01$) and MFI ($p < 0.05$) relative to those without FR loan or those who are landless/marginal land owners or both. But, the interaction effect is insignificant in case of application to bank. This could be because the impact of FR network is significant for a larger land ownership category. Following this, we consider interaction of FR loan with semi-medium and above group in table 7b. As is expected, the interaction effect is now positive and significant in case of application to all the lenders ($p < 0.01$). This finding resonates well with the perceived importance of land as collateral among borrowers, in general when they apply to any credit sector other than to their immediate family and friend circle. This also suggests that FR network facilitates the use of collateral for the relatively wealthier (land rich) households. One may argue that FR network alleviates risk rationing for land rich households. Another possibility is that FR network may reduce quantity rationing since with some amount of loan from friends/relatives, borrowers may become eligible for a loan from other lenders.

Table 7b. FR network and access to credit: the collateral channel

Variables	Bank		Moneylender		MFI	
	outcome	selection	outcome	selection	outcome	selection
any FR loan	-0.4780** (0.2388)	0.5935*** (0.1292)	-0.1899 (0.1416)	0.6143*** (0.0757)	0.2241 (0.3005)	0.6604*** (0.1751)
semimed & above	0.1381 (0.0829)	0.4092*** (0.0253)	-0.1241* (0.0691)	-0.0509 (0.0350)	-0.0827 (0.0858)	-0.1049** (0.0474)
phy asset	-0.0053 (0.0905)	0.3549*** (0.0357)	-0.5969*** (0.1346)	-0.2437*** (0.0903)	-0.2288 (0.1597)	-0.2279*** (0.0814)
fin asset	0.0863 (0.0610)	0.1536*** (0.0301)	0.3108*** (0.1147)	0.1142 (0.0713)	0.3160*** (0.0735)	0.3981*** (0.0269)
male head	-0.0115 (0.0593)	0.3017*** (0.0337)	0.0026 (0.0392)	0.1527*** (0.0375)	0.0924 (0.0654)	0.0357 (0.0350)
age of head	-0.0015 (0.0020)	0.0021** (0.0009)	-0.0001 (0.0018)	-0.0031*** (0.0007)	-0.0039** (0.0019)	-0.0039*** (0.0009)
highest educ	0.0053 (0.0048)	0.0318*** (0.0023)	-0.0051 (0.0047)	-0.0166*** (0.0026)	0.0056 (0.0053)	-0.0010 (0.0026)
pc consp exp	0.0000 (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Hindu	0.0693 (0.0513)	0.0289 (0.0261)	-0.0201 (0.0716)	0.1030** (0.0411)	-0.0308 (0.0605)	0.0272 (0.0320)
uppercaste	0.0521 (0.0504)	0.0110 (0.0243)	-0.0167 (0.0558)	-0.1086*** (0.0362)	0.0292 (0.0544)	-0.0330 (0.0300)
urban	-0.0202 (0.0509)	-0.1691*** (0.0300)	0.0270 (0.0771)	-0.0825** (0.0317)	0.1191** (0.0549)	-0.0696** (0.0288)
salaried/professional	0.0251 (0.0746)	-0.2566*** (0.0235)		-0.1413** (0.0572)	-0.0500 (0.0896)	-0.0523 (0.0480)
low income workers	-0.0936 (0.0573)	-0.2903*** (0.0207)		0.0434 (0.0262)	0.0028 (0.0696)	0.0747** (0.0378)
shock dummy		0.1327*** (0.0194)		0.2222*** (0.0362)		0.0995*** (0.0230)
membership index						2.0913*** (0.1238)
FRloan*semimed & above	-0.0978 (0.1271)	0.1606*** (0.0556)	-0.1305 (0.0937)	0.1728*** (0.0479)	-0.1582 (0.1166)	0.2120*** (0.0657)
State fixed effects	yes	yes	yes	yes	yes	yes
constant	2.0617*** (0.2069)	-1.8609*** (0.1123)	1.9517*** (0.2226)	-1.8150*** (0.1427)	1.7615*** (0.3578)	-1.9690*** (0.1307)
corr(e.select,e.outcome)		-0.8562*** (0.0689)		-0.7951*** (0.0888)		-0.7002*** (0.0893)
corr(e.FRloan,e.select)		-0.3343*** (0.0731)		-0.2901*** (0.0461)		-0.3872*** (0.0958)
corr(e.FRloan,e.outcome)	0.1916 (0.1294)		0.0346 (0.0754)		-0.2030 (0.1778)	

Notes: This table presents the estimates of the collateral channel through an interaction of FR loan with semi-medium & above land ownership dummy for each lender. An endogenous sample selection Probit model is estimated. H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$). Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Though FR loan complements land ownership in the application stage, the interaction effect is not significant to obtain bank or moneylender credit, in both the specifications considered. However, in case of MFI, the interaction effect is negative and significant only for the small and above category ($p < 0.05$) in table 7a. This suggests that FR network facilitates microfinance credit approval for households who own less than 2.47 acres of land (landless and marginal collectively) vis-a-vis those owning more than the threshold. Given the insignificant coefficient of small & above land ownership in the outcome model, we cannot exactly claim that FR network substitutes physical collateral in credit access. But, one can argue that MFI loans are usually collateral free loans and the peer monitoring replaces the need for physical collateral (Besley & Coate, 1995; Ghatak, 2000; Ghatak & Guinnane, 1999). In group lending schemes, the groups are formed among close acquaintances, mostly friends and relatives, and are composed of poorer segment of borrowers with no or limited collateral¹¹. Therefore, in this case, FR loan is indicative of the existence of a close network of friends and/or relatives, which can perform the task of peer monitoring for MFIs, thereby increasing the chances of credit access. However, in table 7b, the interaction effect is not significant when we change the dummy from small and above to semi-medium and above. The base group in semi-medium and above category (table 7b) comprises of the landless, marginal and small land owners taken together. It further strengthens our argument that MFIs cater to credit needs of the landless and the marginal land owners (Parmeter et al., 2020). Though it is the land rich households who are more likely to apply for MFI loan, it is in effect the landless and the marginal land owners who have greater chances of approval.

Political economy channel

The problems of political systems in developing economies including in India have been well documented in the literature. When it comes to public welfare programs, their outreach in most cases lies at the discretion of elected officials (Bardhan & Mookherjee, 2016; Bhattacharya, Kar, & Nandi, 2017). These officials (political elites) are able to raise their own income by way of transferring resources towards themselves and away from the rest of the society, i.e., the target audience (Acemoglu, 2006; Chatterjee & Pal, 2021). During election times, it is commonly observed that a section of elites (patrons) make private transfers to a section of poor and disadvantaged group (clients) as a means of securing their political support, while facing political

¹¹When borrowers have information about each other's projects, it leads to self-selection among borrowers (endogenous peer selection) at the time of formation of groups. The joint liability inbuilt in these groups serves the purpose of screening and monitoring in absence of collateral (Ghatak, 1999, 2000).

competition from other sections of elites (Bardhan & Mookherjee, 2016; Bhattacharya et al., 2017). This is referred to as political clientelism/nepotism in the political economy literature. Previous studies have shown that political connections increase the likelihood of acquiring quality financial information (Y. Zhang et al., 2012). Further, in most cases, the eligibility and allocation decisions on various schemes initiated by the state like development loans, agricultural credit, etc., are made by local bodies and as such credit is a politically provided input (Banerjee & Munshi, 2004; Tsai, 2004; Y. Zhang et al., 2012). Following this, we examine whether there is any association between political network and FR network of households in affecting their credit outcomes. In contrast to FR network, political networks are often seen to shape economic outcomes. Though it is likely that some individual(s) from a household's FR network could be the person in power, for e.g., a politician, it is beyond the scope of this study to disentangle these two types of networks. Nevertheless, it is important to examine if politically connected households are in a better position to utilize their FR networks in getting access to credit, especially from bank, vis-a-vis the households without political connections. A negative significant interaction effect would denote that FR network substitutes influential and powerful connections in credit access, while a positive and significant coefficient would suggest complementarity. This is the 'political economy' channel. For the present study, we define political network as a dummy variable taking value 1 if any member in the household has joined political party¹² or if there is any panchayat member/official in the household or close to the household, and zero otherwise.¹³

Table 8 reports the estimates of political connections and its interaction with FR loan in case of bank, moneylender and MFI, controlling for other variables. Households that are politically connected are more likely to apply for bank loan than those without these connections ($p < 0.01$). This finding is consistent with Zhang et al. (2012) who find that having ties with influential people increases the chances of borrowing from formal sector. Having a loan from friends and/or relatives is similarly associated with a higher probability of application to bank ($p < 0.01$). Thus, both types of networks increase a household's probability to apply for formal credit, which could reflect their higher expectations in getting one. In case of approval, FR network has a negative and significant coefficient (we have given the probable justification in the previous section). Further, political connections are not significant in getting a bank loan. However,

¹²Chatterjee and Pal (2021) have adopted a similar definition of political connections in their paper.

¹³We also include Panchayats in the definition of political network because in India, local governments exert a considerable influence on the way that many public programs are targeted as well as on their operation (Bardhan & Mookherjee, 2016; Bhattacharya et al., 2017; Maitra, Mitra, Mookherjee, & Visaria, 2021).

we observe a positive and significant interaction effect of FR loan and political connections on the probability of bank approval ($p < 0.05$), suggesting a complementarity between these two types of networks. This points to an important observation that when combined with political network, FR network increases the chances of getting a bank loan, instead of reducing it. Thus, FR network is more useful when it is political. We can argue that some of the networks, especially friends can be formed through political connections, and in turn, these connections enable a borrower to obtain formal credit. While previous studies find that political connections increase access to bank credit, our study finds novel evidence on the complementary association between political and FR networks in formal credit sector. This finding has important implications in India where political power determines access to social schemes for the poor. Merely having connections with friends and relatives may not help, in absence of political connections.

In case of access to moneylender credit, the interaction effect is positive and slightly significant ($p < 0.1$). Given the insignificant individual coefficients of FR loan and political network, we may say that these two networks are together significant for approval by moneylender. This is more likely to be true when the moneylender happens to be a well known person in the locality, and may have some political affiliations. So far as microfinance credit is concerned, politically connected households are not only less likely to apply for MFI loan, but are also less likely to get one ($p < 0.01$ and $p < 0.05$ respectively). However, the interaction of FR network with political network dummy is insignificant in case of both application to and approval by MFIs. Thus, unlike the case of bank and moneylender credit, there is no evidence of FR network affecting MFI credit access via political connections. This resonates well with the fact that MFIs are set-up with development oriented goals catering to the needy borrowers.

Table 8. FR network and access to credit: the political economy channel

Variables	Bank		Moneylender		MFI	
	outcome	selection	outcome	selection	outcome	selection
any FR loan	-0.6846*** (0.2124)	0.6781*** (0.1443)	-0.2954 (0.1898)	0.6581*** (0.0617)	-0.0022 (0.3163)	0.6660*** (0.1853)
landownacre	0.0180** (0.0086)	0.0526*** (0.0035)	-0.0058*** (0.0012)	-0.0004 (0.0009)	-0.0034* (0.0020)	0.0006 (0.0008)
phy asset	-0.0210 (0.0803)	0.3591*** (0.0373)	-0.5911*** (0.1329)	-0.2418** (0.0914)	-0.1833 (0.1467)	-0.2565*** (0.0822)
fin asset	0.0695 (0.0541)	0.1478*** (0.0303)	0.3220*** (0.1145)	0.1133 (0.0738)	0.2618*** (0.0623)	0.3790*** (0.0269)
male head	-0.0308 (0.0536)	0.2950*** (0.0320)	0.0073 (0.0413)	0.1521*** (0.0371)	0.0757 (0.0597)	0.0367 (0.0356)
age of head	-0.0017 (0.0018)	0.0019** (0.0009)	-0.0005 (0.0018)	-0.0031*** (0.0007)	-0.0034* (0.0018)	-0.0038*** (0.0009)
highest educ	0.0022 (0.0038)	0.0304*** (0.0023)	-0.0065 (0.0048)	-0.0165*** (0.0027)	0.0056 (0.0052)	-0.0006 (0.0026)
pc consp exp	0.0000 (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Hindu	0.0521 (0.0480)	0.0241 (0.0258)	-0.0345 (0.0746)	0.1051** (0.0407)	-0.0362 (0.0573)	0.0385 (0.0322)
uppercaste	0.0451 (0.0461)	0.0049 (0.0229)	-0.0240 (0.0586)	-0.1052*** (0.0356)	0.0247 (0.0517)	-0.0319 (0.0299)
urban	0.0119 (0.0439)	-0.1246*** (0.0305)	0.0358 (0.0709)	-0.0838** (0.0328)	0.1112** (0.0510)	-0.0790*** (0.0284)
salaried/professional	0.0629 (0.0702)	-0.1951*** (0.0278)		-0.1390** (0.0571)	-0.0291 (0.0790)	-0.0455 (0.0437)
low income workers	-0.0385 (0.0523)	-0.2301*** (0.0222)		0.0451 (0.0310)	0.0183 (0.0591)	0.0832** (0.0332)
shock dummy		0.1135*** (0.0185)		0.2214*** (0.0369)		0.1036*** (0.0228)
membership index						2.6792*** (0.1469)
political network	-0.0394 (0.0550)	0.1336*** (0.0311)	-0.1046 (0.0978)	0.0347 (0.0418)	-0.1606** (0.0706)	-0.3312*** (0.0408)
FRloan*political	0.1844** (0.0804)	-0.0686 (0.0480)	0.2219* (0.1264)	-0.0180 (0.0781)	0.1322 (0.1082)	0.0696 (0.0584)
State fixed effects	yes	yes	yes	yes	yes	yes
constant	2.1166*** (0.1791)	-1.9985*** (0.1169)	1.9753*** (0.2406)	-1.8412*** (0.1390)	1.9433*** (0.3052)	-1.9410*** (0.1297)
corr(e.select,e.outcome)		-0.9168*** (0.0379)		-0.7678*** (0.0936)		-0.7875*** (0.0661)
corr(e.FRloan,e.select)		-0.3499*** (0.0803)		-0.2916*** (0.0422)		-0.3742*** (0.1005)
corr(e.FRloan,e.outcome)	0.2650** (0.1109)		0.0424 (0.0868)		-0.1105 (0.1824)	

Notes: This table presents the estimates of the collateral channel through an interaction of FR loan with political network dummy for each lender. An endogenous sample selection Probit model is estimated. H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$). Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Social expenditure channel

Interpersonal lending and borrowing, such as loans between households and their FR network generally involve an element of reciprocity and requires investment in their network for maintenance, which increases social expenditures of the households (Ferrara, 2003; Heyer, 1989; Zeller, 2006). Lack of investment in social capital may lower credit access of borrowers (Shoji, Aoyagi, Kasahara, Sawada, & Ueyama, 2012; Yuan & Xu, 2015). In case of China, Yuan and Xu (2015) suggests that the poor cannot invest or have low investment in social capital (in the form of transferring resources to other households, for example) due to which they are constrained in informal loan. A similar finding is by Shoji et al. (2012) who examine the determinants of social capital formation in an imperfect credit market in context of Sri Lanka. It finds that households facing credit constraints reduce investments in social capital, which eventually reduces general trust, trust in villagers, and trust in business partners and leads to a potential poverty trap. These studies highlight the importance of spending in the form of gifts as a way to sustain a long term FR network. We conjecture that FR network may affect a household's choices of application to and approval from other credit sources.

One may argue that expenditures incurred on social ceremonies like marriage, funerals and other social functions can change wealth and assets portfolio of borrowers. This in turn, may affect a household's choice of application to lenders outside their network circle. For instance, a household may borrow from a moneylender to finance their social expenditures. In a similar manner, expenditures of this type may affect credit approval by lenders. Though social expenditures may not lead to corresponding income generation, it is also not a waste. Higher social expenditures could be an indication of social cum financial status of borrowers. At the same time, if a household has a network of friends and relatives, it could give an indication to the lender that the loan will be repaid. This is another important channel by which FR loan may affect borrowers' participation in credit market.

Table 9. FR network and access to credit: the social expenditure channel

Variables	Bank		Moneylender		MFI	
	outcome	selection	outcome	selection	outcome	selection
any FR loan	-0.8038** (0.3307)	0.6572*** (0.1721)	-0.5676* (0.2942)	0.4918*** (0.1075)	-0.1149 (0.4010)	0.7447*** (0.2255)
landownacre	0.0168* (0.0085)	0.0530*** (0.0035)	-0.0063*** (0.0013)	-0.0002 (0.0008)	-0.0041* (0.0021)	0.0005 (0.0008)
phy asset	-0.0202 (0.0825)	0.3497*** (0.0351)	-0.6184*** (0.1219)	-0.2367*** (0.0889)	-0.2579* (0.1540)	-0.2243*** (0.0788)
fin asset	0.0596 (0.0547)	0.1525*** (0.0308)	0.2954** (0.1129)	0.1307* (0.0736)	0.3158*** (0.0805)	0.4013*** (0.0268)
male head	-0.0467 (0.0541)	0.2975*** (0.0324)	-0.0057 (0.0428)	0.1592*** (0.0387)	0.0859 (0.0669)	0.0399 (0.0351)
age of head	-0.0016 (0.0018)	0.0019** (0.0009)	-0.0005 (0.0018)	-0.0031*** (0.0007)	-0.0041** (0.0019)	-0.0039*** (0.0009)
highest educ	0.0006 (0.0039)	0.0309*** (0.0023)	-0.0093* (0.0051)	-0.0157*** (0.0026)	0.0020 (0.0054)	-0.0004 (0.0026)
pc consp exp	0.0000 (0.0000)	0.0000*** (0.0000)	-0.0000 (0.0000)	0.0000* (0.0000)	-0.0000* (0.0000)	-0.0000 (0.0000)
Hindu	0.0569 (0.0475)	0.0259 (0.0264)	-0.0290 (0.0726)	0.1060** (0.0412)	-0.0322 (0.0607)	0.0292 (0.0319)
uppercaste	0.0487 (0.0462)	0.0026 (0.0229)	-0.0252 (0.0574)	-0.1077*** (0.0357)	0.0458 (0.0555)	-0.0348 (0.0298)
urban	0.0103 (0.0440)	-0.1359*** (0.0311)	0.0365 (0.0739)	-0.0872*** (0.0319)	0.1385** (0.0548)	-0.0642** (0.0284)
salaried/professional	0.0734 (0.0747)	-0.2001*** (0.0280)		-0.1462** (0.0580)	-0.0155 (0.0853)	-0.0381 (0.0433)
low income workers	-0.0262 (0.0536)	-0.2332*** (0.0220)		0.0432 (0.0307)	0.0518 (0.0648)	0.0861*** (0.0328)
shock dummy		0.1160*** (0.0184)		0.2240*** (0.0372)		0.0978*** (0.0230)
membership index						2.0750*** (0.1243)
log social exp	0.0266*** (0.0089)	0.0003 (0.0049)	0.0276** (0.0124)	-0.0208** (0.0084)	0.0443*** (0.0115)	-0.0173*** (0.0058)
FRloan*logsocexp	0.0201 (0.0245)	0.0007 (0.0152)	0.0334 (0.0217)	0.0241** (0.0091)	0.0220 (0.0249)	0.0020 (0.0152)
State fixed effects	yes	yes	yes	yes	yes	yes
constant	1.9385*** (0.1737)	-1.9628*** (0.1086)	1.8044*** (0.2450)	-1.7051*** (0.1314)	1.4909*** (0.3738)	-1.8893*** (0.1327)
corr(e.select,e.outcome)		-0.9168*** (0.0380)		-0.7500*** (0.0938)		-0.7022*** (0.0977)
corr(e.FRloan,e.select)		-0.3532*** (0.0709)		-0.2981*** (0.0410)		-0.4181*** (0.0888)
corr(e.FRloan,e.outcome)	0.2811** (0.1095)		0.0983 (0.0777)		-0.1165 (0.1743)	

Notes: This table presents the estimates of the social expenditure channel through an interaction of FR loan with logarithm of social expenditure for each lender. An endogenous sample selection Probit model is estimated. H0: Wald test of indep. eqns. ($\rho = 0$) and H0: Wald test of exogeneity of FR loan ($\rho = 0$). Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Table 9 reports the estimates of social expenditure channel for different lenders. A sample selection Probit model is estimated which takes care of the endogeneity of FR loan. FR network (loan) significantly increases the probability of application to bank, moneylender and MFI ($p < 0.01$). Higher social expenditure significantly lowers the probability of application to moneylender ($p < 0.05$) as well as to MFIs ($p < 0.1$). The interaction of FR loan and social expenses is positive and significant so far as application to moneylender is concerned ($p < 0.05$). This suggests that households who have obtained an FR loan and have higher social spending are more likely to apply to moneylender. This is an important finding. It indicates that these households have a costly network and/or a large network to maintain. Since moneylender credit is usually more expensive than bank or MFI loans, this complementarity could mean that such households use their costly network to borrow from moneylender. This finding can be taken as an indication of lack of penetration of banks and MFIs.

So far as credit access is concerned, FR network reduces the likelihood of approval from bank ($p < 0.05$) and moneylender ($p < 0.1$). On the other hand, higher social expenditure is associated with a higher probability of approval from all the lenders. We may argue that higher social expenditure is positively correlated with financial and social status of borrowers and this is likely to increase the chances of getting credit from these lenders. The interaction of FR loan and social expenditure is not significant in case of approval for any lender, though positive. Thus, there is no evidence that FR network affects credit access of borrowers through social expenditures.

4.6 Conclusion

We study the nature of interaction between households' FR network and their participation in formal and informal credit sectors, viz, the bank, the MFI and the moneylender in India. We further explore different mechanisms through which FR network can affect the outcomes of our interest. To address our objectives, we use a sample selection Probit model to account for any possible selection bias together with an instrumental variable framework to address possible endogeneity of FR network.

We provide some novel evidences on the relationship between FR network and access to formal and informal credit. Results indicate that households who have an active FR network

have a significantly higher probability of applying to both formal (bank and MFI) and informal (moneylender) lenders. This may be because a household becomes eligible for a market loan when a portion of its demand is met from FR network or when demand for credit increases due to new investment opportunities. A positive effect of FR network could also suggest that households use their FR network as support in case of emergencies, and FR network may provide them with useful financial information which may encourage them to apply to other sectors. However, we find that a loan from friends/relatives reduces the probability of approval from bank, which is counter-intuitive. On further exploring the pattern of FR loan use among the states of India, we find that there are six states (Haryana, Meghalaya, Assam, Orissa, Madhya Pradesh and Karnataka) for which the coefficient of FR loan on bank loan approval is negative and significant. A probable explanation is that in case of these six states, households with a loan from their FR network demand a higher amount of credit from bank, which only lowers their chances of loan approval vis-a-vis those without FR loan. This result may also be driven by reverse association between FR loan and bank loan approval, which means that a household has taken a loan from its FR network when it could not obtain a bank loan.

Our study also finds evidence of various channels through which FR network may affect borrowing choices of households in India. First, households with an active FR network and those owning more than 4.94 acres of land (semi-medium and above group) have significantly higher chances of application to bank, moneylender and MFI relative to the landless, the marginal and the small landowners (base group) or those without an FR loan or both. This is consistent with the perceived importance of land as collateral among borrowers. One possible argument is that FR network alleviates risk rationing for the land rich borrowers and/or it may reduce quantity rationing of borrowers. Further, we find that MFIs are more likely to give credit to the poorer segment of the society, comprising of the landless and marginal land owners vis-a-vis the land rich households. Second, FR network is complementary to political network when it comes to getting a loan from bank. Political network itself is insignificant but increases access to formal loan in presence of an active FR network. This may be because some of the networks, especially friends can be formed through political connections, and in turn, these connections enable a borrower to obtain bank credit. This finding has important implications in India where political power determines access to various social schemes for the poor. Third, this study also finds that FR network increases the likelihood of loan application to moneylender for households who have a higher social spending, on average. It indicates that these households have a costly network or a large network to maintain. Given that moneylender credit is costlier compared

to loans from other lenders, these households may use their costly network to borrow from moneylender, indicating insufficiency of formal credit sources and of microfinance institutions.

Our study has important implications in context of credit markets in developing economies including India. Despite the widespread prevalence of market loans, such as formal credit (bank, MFIs) and informal credit (moneylender), borrowers continue to rely on their friends and relatives to fulfil their credit requirements. These non-market institutions (NMIs) operate side by side to supplement market insurance (Arnott & Stiglitz, 1991). Though such loans are considered as useful, there is a shadow cost associated with it due to the element of reciprocity. For example, Turvey and Kong (2010) show in case of China that when trust between borrower households and their friendship-relative network is sufficiently high, then informal borrowing amongst them not only crowd out rural credit cooperatives, but also the registered micro-finance institutions (MFIs) which are designed for poor households in the rural and agricultural areas. A similar pattern is observed in India (Muduli & Dash, 2019). This could be a matter of concern because the policies designed to increase outreach of formal sector (bank) and MFIs may be ineffective in areas where borrowers rely heavily on borrowing from their family and friend circle. However, in our study, we mostly observe a beneficial effect of FR network on application to market lenders, and it is through various channels that this effect is evident. We share some similarities with the study by Demont (2016) who finds that penetration of microfinance institutions in Indian villages did not crowd out the existing informal lenders but increased the average volume of credit borrowed due to expansion of new business opportunities. In our study, given that more than 90% of the applicants have been granted credit in case of each lender, the effect of FR network is more evident in the application stage than in case of approval. Thus, FR network facilitates expansion of the credit market in the Indian context. There is no evidence of crowding out, instead crowding in of market loans. These non-market institutions help to meet credit requirements of those borrowers who are rationed or not served by the three main sources of credit.

4.7 Appendix

Exploring the pattern of FR network (loan) use among Indian states

Table 10

Interaction effect of FR network with states

any FR loan* state	outcome model	selection model
any FR loan	-0.4612 (0.2976)	0.6935*** (0.2090)
any FR loan*Himachal Pradesh	-0.7364 (0.5135)	0.3468 (0.2520)
any FR loan*Punjab	-0.3745 (0.4252)	0.5796*** (0.1799)
any FR loan*Chandigarh	3.5492*** (0.5101)	1.1169*** (0.3641)
any FR loan*Uttarakhand	-0.1263 (0.4084)	0.3992 (0.2549)
any FR loan*Haryana	-0.7286* (0.3821)	0.6135** (0.2548)
any FR loan*Delhi	-0.0985 (0.3870)	0.1511 (0.2417)
any FR loan*Rajasthan	-0.3710 (0.2571)	0.2266 (0.2056)
any FR loan*Uttar Pradesh	-0.2729 (0.2377)	0.2184 (0.1872)
any FR loan*Bihar	-0.2378 (0.3692)	0.2092 (0.1486)
any FR loan*Sikkim	3.6821*** (0.4735)	1.4381*** (0.5121)
any FR loan*Arunachal Pradesh	3.3679*** (0.4437)	2.1293*** (0.5618)
any FR loan*Nagaland	-3.4902 (12.3048)	0.8335** (0.3225)
any FR loan*Manipur	4.7142*** (0.6690)	0.5761* (0.3071)

Notes: This table gives the interaction effect of FR network (loan) with each state of India. An endogenous sample selection Probit model is fitted. The reference group is FR loan*Jammu & Kashmir. Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2. 2011-12.

Table 10

Interaction effect of FR network with states (continued)

any FR loan* state	outcome model	selection model
any FR loan*Meghalaya	-6.2552*** (0.4778)	3.1866*** (0.9548)
any FR loan*Assam	-1.0108* (0.5913)	1.0242*** (0.3119)
any FR loan*West Bengal	-0.3781 (0.3020)	0.1202 (0.2163)
any FR loan*Jharkhand	-0.7496 (0.5958)	0.5701* (0.3291)
any FR loan*Orissa	-0.8727*** (0.2432)	0.6976** (0.2750)
any FR loan*Chhattisgarh	-0.6230 (0.4274)	0.2680 (0.2351)
any FR loan*Madhya Pradesh	-0.5103* (0.3035)	0.4045* (0.2082)
any FR loan*Gujarat	-0.5368 (0.3525)	0.5145** (0.2121)
any FR loan*Dadra & Nagar Haveli	4.8667*** (0.4432)	0.2638 (0.2149)
any FR loan*Maharashtra	-0.2784 (0.2899)	0.4817** (0.2149)
any FR loan*Andhra Pradesh	-0.2999 (0.2779)	0.2358 (0.2435)
any FR loan*Karnataka	-0.5607* (0.3092)	0.2438 (0.2013)
any FR loan*Goa		-4.0061*** (0.4007)
any FR loan*Kerala	-0.2484 (0.4693)	0.9785*** (0.1912)
any FR loan*Tamil Nadu	-0.3337 (0.2956)	0.2194 (0.2331)

Notes: This table gives the interaction effect of FR network (loan) with each state of India. An endogenous sample selection Probit model is fitted. The reference group is FR loan*Jammu & Kashmir. Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2. 2011-12.

Chapter 5

Do political connections matter in loan repayment? Evidence from Indian households

5.1 Introduction

Credit markets in developing countries frequently experience strategic default on loans due to weak institutions, where there are also the problems of adverse selection and moral hazard, arising from asymmetric information between lenders and borrowers. Consequently, lenders employ various screening and monitoring instruments, for example, collateral to minimize the risks of default and ensure timely repayment(Sharma & Zeller, 1997). A few studies suggest that while collateral may not be affordable for everyone due to rampant poverty in developing economies, lenders may use alternate means, such as gathering ‘soft information’ about borrowers which is facilitated by borrowers’ possession of connections or networks in their society. Social networks can be defined as the institutions, the relationships, the attitudes and values that govern interactions among people and contribute to economic and social development(Van Bastelaer, 1999). In context of credit market, the usefulness of networks has been mostly realized in context of group lending programs, where there is risk sharing among borrowers and members monitoring one another that lowers the chances of moral hazard and hence default(Besley & Coate, 1995; Ghatak & Guinnane, 1999; Parmeter et al., 2020).

However, one particular type of social network that has garnered more attention in the public discourse is that of political connections. These connections are viewed as more important

in so far as access to information, resources and privileges are concerned, something which is not available to people within their usual networks and may help borrowers to repay (Dufhues, Buchenrieder, Quoc, & Munkung, 2011). But, political connections are often associated with what is called political clientelism, the evidences of which can be found in many developing countries including in India. Political clientelism refers to a situation when a section of elites (patrons) make private transfers to a section of poor and disadvantaged group (clients) as a means of securing their political support, or when local elites influence beneficiary selection by targeting their personal contacts (Acemoglu, 2006; Bardhan & Mookherjee, 2016; Bhattacharya et al., 2017; Chatterjee & Pal, 2021; Maitra et al., 2021). It is frequently observed that eligibility to and allocation decisions in case of many government schemes lies at the discretion of the state and local governments, for example, subsidized credit programs (Banerjee & Munshi, 2004).

While the access to credit is politically determined, it is also possible that the repayment of loan is influenced by the prevailing political system, and law and order situation in any given region. Borrowers repay in the expectation of getting a loan in the future or to avoid punishment due to default. There could be two competing theories as to why the political connections may affect repayment. On one hand, borrowers who have political connections may be more likely to repay their loan if these connections bring in monetary resources or any other form of support that can enable borrowers to repay, in the event that their project goes bad. In cases when the project is a success, political connections may induce borrowers to repay, or in other words prevent the likelihood of strategic default. In that case, political network can be said to exert a positive effect on loan repayment. On the other hand, politically connected borrowers may have information regarding and easy access to upcoming loan waiver schemes of the government, in which case they should have lower repayment rates. Alternately, these borrowers may take undue advantage of their connections and default strategically. This shall suggest a negative effect of political connections on repayment.

Despite the evidences surrounding the importance of political networks, the causal association between these connections and loan repayment in case of individual liability loans, especially at the household level remains rather unexplored in the literature¹. Therefore, we contribute to and complement the previous literature in the following directions. First, we extend beyond the broad literature which examines the role of social networks on loan repayment

¹A few exceptions include Dufhues et al. (2011) and Georgarakos and Fürth (2015).

in case of microfinance institutions/group lending programs. These institutions rely on the concept of ‘peer monitoring’ and ‘social sanctions’ as a mechanism to enforce repayment (Besley & Coate, 1995; Ghatak, 1999; Ghatak & Guinnane, 1999; Hermes, Lensink, & Mehrteab, 2005; Parmeter et al., 2020). Moreover, there are a lot of studies that examine the importance of networks, notably that of political connections in credit access and repayment in context of firms in India and elsewhere (Cole, 2009; Georgarakos & Fürth, 2015; S. Ghosh, 2020; Infante & Piazza, 2014; N. Kumar, 2020; Sapienza, 2006). As the nature of liability for an individual household is likely to be different from that in a group lending program or a firm where people are collectively responsible for repayment, it remains of importance to examine how political connections affect a household’s repayment performance.

Second, we contribute to the existing literature on network and repayment on the methodological front by establishing a causal link between the two. In our model, the treatment assignment is likely to be endogenous. While there could be self-selection by borrowers in developing political connections, this non-randomness may be driven both by observable variables (confounders) that can distinguish borrowers between the treated group and the control group, and by unobservable factors (e.g., peer effects or unobserved family traits) which may simultaneously affect the probability of getting the treatment (political connections) and the outcome (loan repayment). Therefore, we employ the technique of coarsened exact matching (CEM) to balance the treated and the control observations on observable covariates (Blackwell, Iacus, King, & Porro, 2009; Iacus, King, & Porro, 2012) and use suitable instruments for political network to account for its possible endogeneity. To the best of our knowledge, our study is one of the first to effectively combine matching with an instrumental variable (IV) framework to estimate the causal effect of network on loan repayment. Given the intangible nature of social networks and the possibility that different types of networks are interlinked, we also control for other types of social network variables in our model.

Third, we explore channel(s) that could mediate a significant relationship between political network and loan repayment, if any. We hypothesize that political connections help access various schemes of the government, which may bring in resources and help borrowers repay their loan.

Fourth, we examine whether the nexus between political connections and repayment vary with respect to land ownership status of borrowers. It is a common observation in India that

power emanates from landholdings. The landlord class had been a dominant class and is still dominant in terms of power in many parts of the country. Land is an important instrument in a democracy which allows politicians to maintain a long-term patron-client relationship and (Bardhan & Mookherjee, 2016; Dyzenhaus, 2021; Hussain & Tyagi, 2020). India being the largest democracy in the world thus provides an ideal ground for exploring whether political networks affect loan repayment performance of borrowers based on their size of land ownership. We address these objectives using a nationally representative household level data for India.

Our results suggest that borrowers with political connections are more likely to repay their loan vis-a-vis those without these connections, thereby suggesting a positive effect of connections on repayment. We argue that political connections may facilitate access to different welfare schemes of the government which brings in monetary resources or any other form of support that increase repayment performance of borrowers. On further conducting a mediation analysis with government schemes, we find that political connections facilitate access to government schemes, and there is some evidence that these schemes partially mediate the positive relationship between political connections and loan repayment. Overall, this study suggests that there is limited evidence of political clientelism on repayment. Rather, there is a disciplining effect of these connections in the Indian context. The results are robust when we choose different types of coarsening for matching politically connected and unconnected borrowers. On further disaggregating the analysis according to different categorizations of land ownership, our study finds that political connections have a positive and significant effect on repayment for the landless group, but is insignificant for households with positive land ownership. Similarly, in other specifications, we find significant evidence that political network improves repayment probability of borrowers in the lower end of the land distribution. Thus, it is the relatively resource poor households who benefit from political connections in repaying their loan.

The rest of the chapter is structured as follows. In section 5.2, we present a brief overview of the existing literature. Section 5.3 discusses the methodology of our study (data, variables and empirical strategies). In section 5.4, we discuss the results from the model estimation and explore channels between political connections and repayment. Section 5.5 concludes with a discussion of the results and its implications in the credit market.

5.2 Related literature

There is a vast literature that discuss the importance of social networks in credit market. According to Banerjee and Munshi (2004), the role of social networks between transacting parties comes into play when markets are ill-functioning. Social ties can mitigate the adverse consequences arising from asymmetric information between lenders and borrowers (Fisman et al., 2017). However, in other instances, networks, especially political connections have been associated with misallocation of resources and benefits away from the disadvantaged segment of the society (Mansuri & Rao, 2013). We discuss below the existing studies on social network and credit outcomes which share a mixed opinion in regard to the usefulness of social ties.

5.2.1 Social networks and repayment in group lending programs

There is a huge strand of literature that examine the role of social network in loan repayment in context of group lending programs (Ghatak & Guinnane, 1999; Hermes et al., 2005; Parmeter et al., 2020; Van Bastelaer & Leathers, 2006). Ghatak and Guinnane (1999) in their theoretical paper show that the social connectedness within group lending schemes helps to apply sanctions on any undesirable behavior of borrowers. If social sanctions in a group are high enough, borrowers behave diligently, otherwise by defaulting willfully, a borrower incurs social sanction both from bank and the community. Hermes et al. (2005) find in context of Eritrea that though group lending creates its own type of collateral, called social collateral, it is the monitoring and social ties of the group leaders and not the other group members which reduces moral hazard behavior within the group. The authors argue that since the leader serves as the representative of the group, he may have more means to effectively monitor the borrowers than do the other members and in that case others may free ride on the efforts of their leader to prevent moral hazard behavior among the members. Van Bastelaer and Leathers (2006) examine the determinants of repayment rates of joint lending groups of seed farmers in Southern Zambia. Their study finds that bigger size of the group corresponds to higher repayment performance. Also, mutual trust and cooperation within the group is found to improve repayment while common church participation reduces repayment rates as it is associated with lower mutual monitoring and peer pressure among the members. Unlike previous studies that concentrate on a few measures of social network, Parmeter et al. (2020) add to the literature by considering six different measures of social capital (neighborhood, trust, social ties, relatedness, group homogeneity and acquaintances) and interactions among these to study repayment performance of a group lending program in Jordan. Employing a Bayesian Model Averaging technique, this study finds

that almost all forms of networks improve loan repayment performance of borrowers.

5.2.2 Social networks and repayment in context of individual liability loans

The literature on the relationship between social connections and repayment of individual liability loans is rather scant (Dufhues et al., 2011; Georgarakos & Fürth, 2015; Karaivanov & Kessler, 2018). There are a few studies that examine the importance of social networks in context of individual liability loans. For example, Dufhues et al. (2011) estimate the impact of social capital on repayment performance of individual borrowers in context of Thailand and Vietnam. They use four measures of social capital based on the strength of the tie (bonding or bridging capital) and social distance (linking capital). Using a logit model, they find that in case of Thailand bonding social capital improves repayment performance of borrowers because in Thailand social cohesion has been lost in the process of rapid economic development and hence bonding social capital (social capital based on strong ties) is more crucial in getting help during emergencies. While in Vietnam, presence of strong social cohesion makes strong ties redundant when it comes to repayment and what matters is having weak ties with an influential person (bridging link social capital) who can supply borrowers with information or resources not available within their usual networks. In case of Europe, Georgarakos and Fürth (2015) study the causal role of social capital and various prevailing beliefs about corruption on household repayment behavior. They instrument the social capital variables with historical regional variation in quality of political institutions over the period 1600 to 1850 and with literacy rates at the end of the 19th century. Results suggest that when a significant fraction of households believe in the presence of corruption in the country, there is a higher probability of borrowers falling into arrears indicating that escaping legal punishment is easier in more corrupted regions. On the other hand, high stocks of social capital proxied by generalized trust and/or participation in voluntary associations reduce the likelihood of arrears. Karaivanov and Kessler (2018) build a theoretical model to show that borrowers' choice between formal (collateral based) credit and informal (social capital based) credit and their tendency to default strategically is based on their perceptions about the loan source. On one hand, they prefer informal loans a priori, as they carry lower interest rate and collateral due to being backed by social ties. On the other hand, formal loan may be preferred because in the event of default, only a part of the collateral (physical capital) is seized by the lender, while in case of default on informal loans the social capital is entirely lost. Using household data from rural Thailand,

this study finds that the theoretical predictions are consistent with patterns observed in the data.

5.2.3 Political networks in credit access and repayment

There is a vast literature that find evidence of political connections significantly affecting credit access by firms in different countries. Specifically, it has been established that lending behavior of government owned banks are often guided by political considerations, that is, by the political party in power in the same region where the bank operates (Chen, Liao, Lin, & Yen, 2018; Fu, Shimamoto, & Todo, 2017; Infante & Piazza, 2014; Khwaja & Mian, 2005; Sapienza, 2006). A common pattern observed in these studies is that state owned banks charge lower interest rates to their borrowers, but at the same time experience higher default rates compared to private banks. For example, Sapienza (2006) and Infante and Piazza (2014) in context of Italy, Khwaja and Mian (2005) in case of Pakistan and Fu et al. (2017) in case of Indonesia find that state owned banks indeed serve as a mechanism to supply political patronage to the firms when government owns shares in this firm or if politicians are on its board of directors or if highly-ranked managers personally know any politician. Similarly, Chen et al. (2018) examine whether political connections of government banks influenced lending decisions and operating performance during the global financial crisis. Using global data from 41 countries from 2004 to 2009, this study concludes that government banks with politically connected CEOs experienced significantly higher loan default rates and worse operating performance during the crisis than those without politically connected CEOs. In addition, these politically connected CEOs were less likely to be penalized than others for poor performance of their banks.

5.2.4 Social networks and credit outcomes: the Indian case

Political or elite capture is very common in a developing economy which is beset with high inequalities in income and wealth, lower literacy rates and have considerable disparities in terms of caste, race and gender. India is not an exception to this. This combined with an underdeveloped credit market paves the way for clientelism to operate. This comes with its own benefits and costs, though the costs outweigh the benefits in most cases. A few studies that find a positive effect of social ties on credit access and repayment include Banerjee and Munshi (2004) and Fisman et al. (2017). In their paper, Banerjee and Munshi (2004) study the impact of community networks on capital investment behavior in the knitted garment industry

in Tirupur, India, between firms owned by two different communities, the grounders and the outsiders. The grounders were the agriculturalists from Tirupur while outsiders were migrants from other parts of India. The study finds that the grounders had higher capital investment than the outsider firms. This is attributable to the fact that the grounders borrowed more from their informal (social) networks and hence had lower opportunity costs of capital than the outsiders. Moreover, social ties have been found to mitigate information asymmetries in lending. Using data from a state-owned bank in India, Fisman et al. (2017) find that cultural proximity between lenders and borrowers, as defined by both belonging to the same minority religion or belonging to the same caste (in case of same majority religion) reduces credit rationing, and this in turn leads to larger credit disbursal, lower collateral requirements and lower default probabilities. The authors go on to argue that this finding can be explained by community ties reducing information frictions, rather than promoting in-group favouritism in lending.

However, most studies indicate the adverse consequences of social connections, especially political networks on the economy. For instance, Cole (2009) finds evidence of political capture on government owned banks in India. His study suggests that agricultural credit increases by about 5-10% points in an election year with defaults rates increasing during that time; however, this pattern is not observed in off election years or in private bank lending. In a similar study, N. Kumar (2020) shows that political pressure induces increased bank lending to farmers before elections and it crowds out lending to manufacturing firm, the cost of which is huge. His study reveals that average agricultural sector lending during election years was 9.4% higher than during non-election years, while lending to manufacturing firms during the same period was 2.7% lower compared to non-election years. Manufacturing firms are forced to cut down production and operate at lower factor utilization due to reduced bank credit. Moreover, increased agricultural lending before the elections led to excessive indebtedness of farmers that ultimately required a costly government bailout in 2008. S. Ghosh (2020) using bank-level data for India comes up with a similar finding that increase in government intervention is associated with a significantly higher volume of lending to agriculture. In a recent study, Maitra et al. (2021) echo the concern that public welfare programs, notably subsidized credit programs are often subject to political capture and have an anti-poor bias, and this leads to resource misallocation away from those who actually are in need of such schemes. They make a comparison between public intermediaries appointed by local government council (GRAIL scheme) and private intermediaries who are well-known traders or lenders in their village (TRAIL scheme), both of whom are entrusted with the task of selecting eligible small holder farmers for a subsidized

credit program, to examine which approach results in better loan outcomes. Using data from 48 selected districts in West Bengal, their study finds that the loan-take up rates, repayment rates and farm output (potato) are comparable across the two schemes. However, farm incomes increased significantly only in the private trader scheme. This is explained mostly by the fact that the TRAIL agents had better monitoring capacity and provided superior business advice to their borrowers, which reduced their production costs considerably and contributed to larger farm profits than under the GMAIL scheme.

5.3 Methodology

5.3.1 Data Source

We use data from the second round (2011-12) of India Human Development Survey (Desai et al., 2015). It is a nationally representative, multi-topic survey of 42,152 households in 1,420 villages and 1,042 urban neighborhoods across India. For the focus of our study, we restrict our analysis to the sample of households who have borrowed a loan. The sample consists of 22,630 borrower households of which 24.4% have repaid their loan. About 34.8% of the borrowers have political connections.

5.3.2 Conceptual framework

We seek to estimate the causal effect of political network on loan repayment. However, simply comparing the repayment rates between the treated and the control group may produce biased results if the two groups are very different. Table 3 below shows that this is in fact the case. The politically connected and unconnected borrowers significantly differ across all the covariates (except the index of physical assets, loan size and membership in social groups). To account for this difference, we balance borrowers between the two groups by employing the technique of coarsened exact matching (CEM). This matching method gives users the flexibility of choosing the degree of balance between the treated and the control groups ex-ante. The advantage of CEM over other matching methods lies in that it does away with the ‘curse of dimensionality’ problem where exactly matching on all variables leads to a smaller sample size (Blackwell et al., 2009; Iacus et al., 2012). Rather, it requires coarsening on fewer variables such that when we condition on these, the treatment status and potential outcome are independent of the remaining covariates (Fowler, 2012; Gaye, 2022). We discuss this technique in details in section 3.5.

However, estimation of causal effect via matching techniques require that conditional independence assumption (CIA) is satisfied, i.e., after conditioning on the observed covariates, treatment status and potential outcomes are independent. But, in our case, the possibility remains that unobserved factors (for e.g., peer effects or unobserved family traits) may shape a household's decision to get politically connected, possibly violating CIA (Bovenberg, Rottner, & Eberhart, 2019; Deshpande & Khanna, 2021; Wooldridge, 2010). Political network is likely to be non-random as households may self-select themselves into having or not having such connections. For example, suppose that a household has a relative who is a political party member. Now, if it is to get any financial help from this relative, it must support him which can be achieved by any household member becoming a member of the party. To account for the possible endogeneity of the treatment variable, we use an instrumental variable regression on the matched sample obtained via CEM. This effectively takes care of any confounding effect arising from both observable as well as unobservable factors. Since matching alone leads to 'as if' random assignment by balancing on observed covariates, we combine matching with an endogenous regression framework by using suitable instruments for political network. We discuss in details about the instruments in the next section.

5.3.3 The model

We estimate the treatment effects model as follows. Here, i denotes the i^{th} household. Equations (1) and (2) denote the potential outcome model for the treated group denoted by the subscript 1 and for the control group denoted by the subscript 0 respectively. By definition, the treatment variable $pol.network = 0$ and hence $\beta_1 = 0$ in equation (2). $loanrep$ is the loan repayment dummy and this is regressed on the treatment variable $pol.network$ and the vector of covariates denoted by X . We include state fixed effects ($\delta_{s,i}$) in our model to account for the different political atmosphere, law and order situation, etc. across states and to take care of any time invariant unobserved variability (differences) across states. μ_{i1} and μ_{i0} are the error terms in the two models and these follow a normal distribution. Equation (3) denotes the model of political network variable and this is regressed on the instruments denoted by $pol.confidence$ and $years inplace$ and the vector of covariates X . ν_i is the error term in this model. With equation (3), we are augmenting the treatment effects model with an instrumental variable framework. Equation (4) is the observed outcome model which is equal to the outcome of the treated group when $pol.network = 1$ and is equal to the outcome of the control group when

$pol.network = 0$. We thus estimate the following model.

$$loanrep_i^1 = \alpha_0 + \alpha_1 pol.network_i + \alpha_2 X_i + \delta_{s,i} + \mu_{i1} \dots (1)$$

$$loanrep_i^0 = \beta_0 + \beta_1 pol.network_i + \beta_2 X_i + \delta_{s,i} + \mu_{i0} \dots (2)$$

$$pol.network_i = \gamma_0 + \gamma_1 pol.confidence_i + \gamma_2 yearsinplace_i + \gamma_3 X_i + \delta_{s,i} + \nu_i \dots (3)$$

$$loanrep_i = pol.network_i * loanrep_i^1 + (1 - pol.network_i) * loanrep_i^0 \dots (4)$$

5.3.4 Outcome variable, treatment variable and control variables

Table 1 presents the definitions of variables used in this study and table 2 provides the descriptive statistics. The dependent (outcome) variable is ‘loan repaid’ which is a dummy taking a value 1 if a given household has repaid its largest loan, and zero otherwise. The treatment variable is political network. It is a dummy variable taking value 1 if any member in the household has joined political party or if there is any panchayat member/official in the household or close to the household, and zero otherwise². Considering their binary nature, we employ probit model to estimate both the probability of repayment and the probability of having political connections.

We control for a number of explanatory variables in the model to reduce the possibility of omitted variable bias. These can be clubbed under a) household characteristics which include demographic characteristics and wealth position, b) loan variables and c) networks other than political connections. We also include state fixed effects (by including dummies for states) in our model to account for possible variation across states in terms of political atmosphere, level of economic development, law and order situation, and to account for any unobserved time invariant variability across states. We present below a discussion on construction of some of the variables.

²A similar definition of political connections has been employed by Chatterjee and Pal (2021) in their study. We also include Panchayats in the definition of political network because in India, local governments have a considerable discretion on the implementation of public welfare schemes (Bardhan & Mookherjee, 2016; Bhattacharya et al., 2017; Maitra et al., 2021)

Table 1. List of variables used in the study

Variables	Description of the variables
loan repaid (dependent variable)	=1 if the HH has repaid its largest loan; 0 otherwise
Independent variables	
HH characteristics	
land ownership	volume of land ownership in acres
phy asset index	index of physical assets
fin asset index	index of financial assets
HH size	household size
male head	= 1 if the HH is headed by male; 0 otherwise
age head	age of the household head
	= 0 if HH is engaged in cultivation or allied agriculture (base group);
primary occupation	= 1 if HH is salaried or has organized business or profession or earns income through pension/rent/dividend; = 2 if HH is engaged in low-income jobs like agri./non-agri. wage labor, artisan, petty shops, small business
log con exp	Logarithm of monthly per capita consumption expenditure of the HH
income	annual income of the household
highest educ	highest level of education of any member in the HH
Hindu	= 1 if the HH belongs to Hindu religion; 0 otherwise
upper caste	= 1 if the HH belongs to Brahmin or other general category; 0 otherwise
idiosyncratic shock	= 1 if HH suffered loss due to any major illness/accidents or death; 0 otherwise
covariant shock	= 1 if HH suffered loss due to drought/flood/fire or crop failure; 0 otherwise
any insurance	= 1 if HH has taken up life or health insurance; 0 otherwise
urban	= 1 if the HH belongs to urban area; 0 otherwise
govt. schemes	= 1 if the HH has access to any govt. life, health or crop insurance, toilets, Kisan credit card, Indira Awas Yojana, girl child registration scheme
landed	=1 if the HH owns land; 0 otherwise
small and above	=1 if the HH owns more than 2.47 acres of land; 0 otherwise
semi-medium and above	=1 if the HH owns more than 4.94 acres of land; 0 otherwise
medium and above	=1 if the HH owns more than 9.88 acres of land; 0 otherwise

We consider three forms of wealth: land ownership (in acres), physical assets and financial assets. We construct an index for each of physical assets and financial assets since there are a number of items under each type. Physical assets include house, cycle, sewing machine, scooter, television, air conditioner, electric fan, washing machine, computer etc. Financial assets include investments made by the household in mutual funds/shares/bonds, expansion in house or property, fixed deposits, bank savings or current account, chit fund/SHG/credit society account, post office account and gold and jewelry. Considering the binary nature of each item³, we construct a correlation matrix with the various items and then run a factor analysis to get the index. As far as the income is concerned, the data reports a total income variable constructed from earnings from about 50 different sources. Again, negative farm income is reported by about 9% of the sample due to crop failures and other expenses, which in turn gives rise to

³The household was asked whether it possessed a particular asset, for e.g., car.

Table 1. List of variables used in the study(Continued)

Variables	Description of the variables
Independent variables	
Loan variables	
log loan	logarithm of size of the largest loan borrowed by the household
largest formal	= 1 if the largest loan is from formal sector; 0 otherwise
loan productive	= 1 if loan is obtained for productive purposes; 0 otherwise
single loan	= 1 if HH took a single loan in the last five years; 0 otherwise
Social networks	
political network	= 1 if any member in HH joined political party or if there is any panchayat member/official in the HH or close to the HH; 0 otherwise
(Treatment variable)	
member credit group	= 1 if any member in Self Help Group, credit/savings Group, agricultural, milk, or other co-operative; 0 otherwise
member social group	= 1 if any member in religious group, social group or festival society, caste association; 0 otherwise
public meetings	= 1 if any HH member attends public meetings; 0 otherwise
Instruments for political network	
political confidence	Refers to confidence in politicians to fulfill promises or confidence in panchayats to implement public projects. It is a categorical variable taking value 0 if there is hardly any confidence in the political system; 1 for moderate confidence and 2 for great deal of confidence
years in place	no. of years a household has resided in the current locality

Notes: Table 1 provides a description of all the variables used in this study. The questions asked to a household (HH) pertain to the last five years preceding the date of survey. Source: IHDS-2, 2011-12

negative total income estimates for about 1% of the households (IHDS, 2011-12).

The loan variables include loan size, source of the loan, purpose of the loan and whether a single loan has been obtained⁴. In this study, all the loan variables pertain to the largest share of loan obtained by a household. The rationale behind this specification is that a borrower should usually apply first to that lending source from where he expects to meet most of his credit requirement, after which he may resort to other lenders for any unmet demand. We divide the source of loan into formal and informal. Formal lenders include bank, government programs and other credit programs such as Kisan credit card, LIC and provident funds. Informal lenders consist of moneylenders, employers, suppliers, builders, middlemen, friends and relatives, Microfinance Institutions, Self-Help groups, NGOs and community credit group. We have followed the literature while making this distinction⁵. We classify the purpose of loan

⁴We do not include the interest rate as a regressor in the model since about 39.85% of the respondent borrower households did not report any interest rate, monthly or annual. Including this variable would lead to a considerable reduction in our sample size.

⁵Formal lenders (e.g., banks) neither have information about relevant borrower characteristics nor use social

into productive and unproductive. The distinction between these two is that in case of unproductive loans, the income generation capacity is not in the immediate horizon, unlike the case with productive investments (Hulme et al., 1996; Ramachandran & Swaminathan, 2002). Here, productive activities include buying house, land, and agricultural equipment, investment in agriculture, business and purchase of vehicles. Unproductive expenditures include spending on household consumption, medical, educational and marriage expenses. Educational investment requires a long gestation period in order to generate income. Good health leads to income generation indirectly by increasing the work capacity of individuals, and hence medical expenses do not directly contribute to income. Expenditures on consumption increase well-being of people but without any direct contribution to income generation. In a similar manner, even though marriage leads to social mobility and increases access to kinship resources, it does not directly add to income.

While estimating the causal role of political connections on repayment, we must control for other types of networks. As these are intangible and complex in nature, the possibility remains that different types of networks are interlinked (Parmeter et al., 2020). Thus, we include a number of social network variables including memberships in credit associations, memberships in social and religious groups and participation of households in public meetings.

In table 2, we present descriptive statistics of the variables used in the study. As for the dependent variable, we can see that about 24.4% of the borrowers have repaid their largest loan obtained from any lender. Likewise, 34.8% of the borrowers have received the treatment, that is, they have some form of political connections. The summary statistics of all the covariates are provided in the table. For the continuous variables, the mean values are reported along with their minimum and maximum values in the sample while for the categorical variables, the proportion of households belonging to the specified group has been reported.

ties to enforce repayment, while informal lenders (e.g., MFIs, moneylenders) do both. For instance, MFIs rely on the concept of peer monitoring, while moneylender or employer can use violent means to enforce repayment (Andersen & Malchow-Møller, 2006; Besley & Coate, 1995; Jain, 1999; Karaivanov & Kessler, 2018; Zeller, 2006).

Table 2. Summary statistics

Table 1: Summary Statistics

Variables	Proportion	Std.dev		
Loan repaid (dependent variable)	0.244	0.430		
Independent variables				
Categorical	Proportion	Std.dev		
political network	0.348	0.476		
male head	0.879	0.326		
upper caste	0.239	0.426		
Hindu	0.842	0.364		
urban	0.292	0.455		
idiosyncratic shock	0.434	0.496		
covariant shock	0.241	0.428		
any insurance	0.381	0.486		
single loan	0.387	0.487		
loan productive	0.439	0.496		
largest formal	0.450	0.497		
member credit group	0.321	0.467		
member social group	0.158	0.365		
public meetings	0.326	0.469		
govt. schemes	0.304	0.460		
landed	0.492	0.500		
small and above	0.362	0.481		
semi medium and above	0.248	0.432		
medium and large	0.131	0.338		
occupation : cultivator and allied (base)	0.302	0.872		
salaried and others	0.203			
low income workers	0.496			
Continuous	Mean	Std.dev	Min	Max
land ownership	4.622	12.908	0	600
phy asset index	-0.045	0.223	-0.402	1.102
fin asset index	0.262	0.230	0	1.260
log con exp	11.443	0.697	8.581	15.222
household size	5.045	2.333	1	33
age of the head	48.875	12.805	16	99
highest educ	8.015	4.996	0	16
log loan	10.313	1.473	3.912	18.133

Notes: This table provides descriptive statistics of the variables used in the study.

Means and proportions are reported for continuous and for categorical variables respectively. For the occupation variable with three categories, fraction of HHs in each group is reported. Source: IHDS-2, 2011-12.

In table 3, we report t-tests of means (of continuous variables) and of proportions (of dummy covariates) between the politically connected and unconnected households. While they differ significantly in terms of almost all the observed covariates (initial conditions), we note here some important distinction between the two groups with respect to the observed characteristics. On average, the treated group owns about 6.35 acres of land which is almost double the amount of land owned by the control group which is 3.70 acres. Not just in terms of size of land, the two groups also differ significantly if we consider the fraction of each group belonging to a specific land ownership category. Politically connected borrowers have a much greater fraction of landed (59.60%) than the unconnected (43.65%). The fraction of small and above in treated group (45.60%), of semi-medium and above in treated group (32.26%), of medium and large in treated group (17.58%) are larger than in the control group (31.19%, 20.75% and 10.76% respectively). There is a regional variation within households so far as political connections are concerned. Among the rural segment, about 34.38% of borrowers are politically connected while this fraction is only 19.56% among the urban households.

We also observe a difference between the treated and control group in terms of social groups. For example, the proportion of upper caste households is less within the politically connected (21.6%) than the unconnected (25.08%). However, the proportion of the Hindus is more among the treated group than in the control group (86.11% > 83.20%). Another important observation is that there is a higher fraction of borrowers in the treated group (30.37%) who have experienced covariant (group) shocks than those in the control group (20.79%). The treated and the control groups also differ significantly with respect to the loan characteristics. Among the households who are not politically connected, there is a higher fraction taking a single loan (41.32%) vis-à-vis the connected borrowers of whom only 33.68% have single loan and the rest took multiple loans. The treated have a slightly higher fraction investing in productive activities (45.9%) relative to the control group (42.75%). Also, the treated are more likely to get the largest loan from formal sector (47.72%) vis-à-vis the control group (43.50%). So far as access to other social networks is concerned, there is a distinction between the two groups. The politically connected borrowers have a much greater tendency to attend public meetings (46.53%) relative to the unconnected (25.21%). In terms of membership in credit type organizations, proportion of politically connected are more (34.98%) than unconnected (30.56%). However, there is no significant difference between them when it comes to membership in social groups like religious and caste associations, festival societies, etc.

Table 3. t tests of means/proportions of covariates between treated and control groups

Variables (continuous)	Treated	Control	Diff	Std. error
land ownership	6.350	3.699	2.651***	0.182
phy asset index	-0.048	-0.044	-0.005	0.003
fin asset index	0.284	0.250	0.034***	0.003
log con exp	11.462	11.433	0.028***	0.010
household size	5.157	4.984	0.173***	0.033
age of head	49.445	48.570	0.875***	0.182
highest educ	8.285	7.870	0.416***	0.071
log loan	10.319	10.310	0.010	0.021
Variables (dummy)				
male head	0.888	0.874	0.014***	0.005
upper caste	0.217	0.251	-0.034***	0.006
Hindu	0.862	0.832	0.030***	0.005
urban	0.196	0.344	-0.148***	0.006
idiosyncratic shock	0.444	0.428	0.016**	0.007
covariant shock	0.304	0.208	0.096***	0.006
any insurance	0.409	0.366	0.043***	0.007
single loan	0.337	0.413	-0.076***	0.007
loan productive	0.459	0.428	0.031***	0.007
largest formal	0.477	0.435	0.042***	0.007
member credit	0.350	0.306	0.044***	0.007
member social group	0.163	0.155	0.008	0.005
public meetings	0.465	0.252	0.213***	0.007
govt. schemes	0.351	0.278	0.073***	0.007
landed	0.596	0.437	0.159***	0.007
small and above	0.456	0.312	0.144***	0.007
semi medium and above	0.323	0.208	0.115***	0.006
medium and large	0.176	0.108	0.068***	0.005

Notes: This table presents difference in means/proportions of covariates between the treated and the control groups. ***, ** and * denotes significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

Instruments for political network

We instrument network by a) the level of confidence the household has in politicians/political party members or panchayat members to solve the local problems in their community and b) number of years the household has resided in its current locality. We construct the level of political confidence as follows. The respondents were asked if they have any confidence in politicians to fulfill promises or confidence in panchayats to implement public projects. Each type is a categorical variable taking value 0 for no confidence at all; 1 for some confidence and 2 for a great deal of confidence. We sum up the responses for the two types of confidence and arrive at five values ranging from 0 to 4 for the combinations (0,0), (1,0), (0,1), (1,1), (2,0), (0,2), (2,1), (1,2) and (2,2). We create a categorical variable 'political confidence' with three categories such that we assign value 0 if the sum is 0, that is, there is hardly any confidence in

politicians or panchayat members. If the sum is 1 or 2, we assign value 1 to denote moderate degree of confidence, that is, if there is some confidence in at least one of them or a good deal of confidence in one and none in the other. Finally, we assign value 2 if the sum is 3 or 4 to indicate of high level of confidence in the political system. This is when there is high level of confidence in one and moderate degree of confidence in the other or high degree of confidence in both.

An instrument must satisfy two conditions in order to be valid: instrument relevance (it must have good correlation with the endogenous variable) and instrument exogeneity (it should not affect the outcome variable only except via the endogenous variable). It is intuitive to argue that the higher the level of confidence in the political system, more likely people are to join such institutions. A simple analysis of proportion of borrowers with political connections by political confidence suggests that as the level of confidence of borrowers on the political system increases on average, the fraction of them getting politically connected also increases. Without any confidence, the fraction with connections is about 32.41%, with moderate degree of confidence, the fraction of borrowers getting connected increases to 34.20% while with high amount of confidence, this percentage increases further to 38.86%. But this variable is unlikely to affect the probability of repayment directly⁶.

So far as years in place is concerned, it is likely to be correlated with the likelihood of developing political connections (Banerjee & Munshi, 2004). However, this is not likely to affect a household's repayment probability directly except via these connections. One might argue that when a household has been living in a locality for long, it may develop other informal networks that can directly affect their repayment performance. Hence, we control for other network variables in our model.

5.3.5 The coarsening procedure

The CEM method satisfies some additional statistical properties not fulfilled by other matching methods (Blackwell et al., 2009; Iacus et al., 2012). First, CEM is an MIB (monotonic imbalance bounding) method which implies that when we choose a coarsening level for a variable, the maximum degree of its imbalance between the treated and the control group is determined ex-ante so that the degree of imbalance can be as less as possible. Further, the coarsening choice for any one variable do not have any impact on the imbalance bound for any of the

⁶However, we note that households may have political connections even if they have no confidence in the prevailing political system.

other variables. Second, CEM satisfies the congruence principle by operating in the same space where the vector of covariates X was created and its variables were measured. This enables us to run the analysis with the same structure of the variables as their starting point.

CEM works in the following manner. We choose a subset of covariates from the available set of variables for our study. Each variable is then temporarily classified into meaningful groups(bins), followed by exact matching on the coarsened data. The observations that have the same values for all the coarsened variables are grouped into a single stratum. Next, those strata that do not have at least one of the treatment and control observations are dropped out of the data set. Finally, we run the analysis on uncoarsened values of the matched data set(Blackwell et al., 2009; Iacus et al., 2012; Mishra & Sam, 2016). For this study, we choose the following variables for the coarsening procedure: annual income of the household, the primary occupation (income source), the gender and the age of the household head (whether male), the size of the largest loan obtained and the purpose of this loan (whether obtained for productive purposes). These are such variables which are likely to affect the loan repayment probability (outcome) directly, may be independent of the treatment assignment(Fowler, 2012). We select the cutoffs for the continuous covariates as shown in the parentheses below each covariate in table 4. The cutoff points are chosen so as to have a uniform number of observations in each bin. The summary statistics indicate that this matching has been able to produce desirable matches and has retained about 96.61% of the sample⁷.

5.4 Results and discussion

5.4.1 Average treatment effect (ATE) and average treatment effect on the treated (ATET)

In table 5 we present the estimates of the causal effect of political connections on loan repayment by borrower households. The ATET gives the treatment effect for the sample of borrowers who have actually received the treatment. On the other hand, the ATE is a weighted sum of the treatment effects for the treated group and for the control group (the latter denotes the counterfactual outcome). We note here that since our aim is to make inferences about the target population, we multiply the weights generated from the matching process with the survey weights. This gives us the measures of population average treatment effect for the entire pop-

⁷Recent applications of this method include Gaye (2022) and Mishra and Sam (2016).

Table 4. Matching summary

Variables	Univariate imbalance(L1)	
annual income ('000) (-867.025 0 2000 3000 5000 7000 9000 11360)	.0291	
age head (15 25 50 60 99)	.02907	
logarithm of loan size (3.91 9.15 9.9 10.7 11.51 18.133)	.03328	
primary occupation	0.0000000000000081	
male head	0.0000000000000028	
loan productive	0.0000000000000014	
Multivariate $L1$ distance	.774	
	Treated	Control
All sample	7717	14432
matched	7678	14298
unmatched	39	134

Notes: This table reports the matching summary of the variables used for coarsening. The cut-off points chosen for the continuous variables are reported in the parentheses. The default coarsening is chosen for the categorical variables. The $L1$ statistic represents the difference in multivariate histogram of the chosen covariates between the treated and the control groups, such that $L1=0$ denotes perfect global balance while $L1=1$ denotes complete separation. $L1$ denotes imbalance with respect to each covariate between the two groups.

ulation (PATE) and the population average treatment effect on the treated (PATT)(DuGoff, Schuler, & Stuart, 2014). As a baseline specification, we estimate treatment effects using the inverse-probability weighting method, where we do not address possible endogeneity of political network. This technique involves a two step process to compute the treatment effect. In the first step, the parameters of the treatment model are estimated and then the inverse probability weights are computed. In the next step, the weights obtained in the first step are used to calculate weighted average of the outcome for each of the treated group and the control group. The difference of these weighted averages gives us the treatment effect. The second column of table 5 provides the results of the base model. We find that political connections have a positive effect on repayment, suggesting that these connections may help borrower access resources or support which enables them to repay. However, the coefficient of ATET is not significant. The ATE is also positive but is insignificant. It suggests that in the counterfactual state, if the control group was given the treatment (political connections), they would be more likely to repay than if they are not treated, but the effect is insignificant. The estimates of the treatment model (of political network) are provided in table 5A in the appendix.

Next, we augment our treatment effects model with an instrumental variable framework to account for the possible endogeneity of the treatment indicator (political network). We estimate three models here, denoted by IV model 1, IV model 2 and IV model 3. In IV model 1, we estimate the treatment effect of political network on repayment controlling for household level

characteristics and the state fixed effects. In IV model 2, we control for the loan variables like the loan size, source and purpose of the loan, and the number of loans obtained by the given household. Finally, in IV model 3, we include other social network variables such as memberships in different organizations. We discuss the results of these models one by one. The estimates of all other covariates on loan repayment are given as a separate table 5C in the appendix and the discussion is provided in section 4.2 below.

In IV model 1, the positive and significant coefficient of ATET ($p < 0.01$) indicates that households that are politically connected are more likely to repay their loan relative to those without these connections, thereby suggesting a positive effect of connections on repayment. One probable argument could be that political connections may help borrowers access monetary resources or any other form of support that help them to repay their loan. The reduced form model of political network suggests that this variable has positive and significant correlation with both the instruments, years in place and level of political confidence⁸. The coefficient of years in place shows that the longer a household has lived in their current locality, more likely they are to develop political connections over time. Similarly, relative to having no confidence in politicians and/or panchayats, if a household has some confidence ($p < 0.01$) or high confidence ($p < 0.01$) in the political system, it has a significantly higher probability of having political connections. The significant Wald test (chi2) statistic indicates that political network is indeed endogenous in our model. The full reduced form model of political network is presented in table 5B below.

The above results hold in the subsequent specifications (IV model 2 and IV model 3). The Wald statistic is less significant now at 10% level ($p < 0.1$), but it does point towards the endogeneity of the treatment variable. Thus, we find that political connections have a positive impact on loan repayment across all the specifications. The ATE is also positive and significant throughout all the models. This suggests that when we consider the full sample of borrowers, they are more likely to repay their loan if they have political connections than if they are not connected. While we may argue that the positive effect of political connections on loan repayment could arise because connected households may have an easy access to resources, we need to examine empirically if this is the case. We conjecture that political connections may enable borrower access various schemes of the government, which in turn help them to repay

⁸The complete results of the reduced form model of political network are presented in table 5B in the appendix.

their loan. In the next section, we explore whether governmental schemes serve as a mediating channel between these connections and repayment probability of borrower households in India.

Table 5. Treatment effect of political network on loan repayment

	Base model	IV model 1	IV model 2	IV model 3
ATET				
political network	0.0125	0.1703***	0.1597**	0.1561**
(1 vs 0)	(0.0096)	(0.0611)	(0.0658)	(0.0685)
ATE				
political network	0.0142	0.4974***	0.3921***	0.3876**
(1 vs 0)	(0.0093)	(0.0858)	(0.1409)	(0.1556)
Reduced form model of political network				
Years in place	-	0.0026***	0.0026***	0.0026***
		(0.0006)	(0.0006)	(0.0006)
Moderate political confidence	-	0.1611***	0.1611***	0.1611***
		(0.0393)	(0.0393)	(0.0393)
High political confidence	-	0.2787***	0.2787***	0.2787***
		(0.0472)	(0.0472)	(0.0472)
HH characteristics	yes	yes	yes	yes
Loan variables	yes	no	yes	yes
Social networks	yes	no	no	yes
State fixed effects	yes	yes	yes	yes
Wald test(chi2)	-	9.77**	6.22*	5.38*

Notes: This table presents the treatment effect of political network on loan repayment on the matched sample. The base model does not address endogeneity of political network. The third, fourth and fifth columns report the treatment effect incorporating endogeneity of the network variable and additional covariates are controlled for as we move from IV model 1 to IV model 2 and IV model 3. Robust standard errors are in parentheses.

***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

5.4.2 Effect of the control variables on loan repayment according to treatment status

Table 5C in the appendix provides the estimates of the covariates on the probability of loan repayment. Among the asset variables, physical assets significantly increase the probability of repayment ($p < 0.01$) both for those who are politically connected (treated group) and those who are not (control group) as we move from specifications (1) to (3). However, the index of financial assets is positive and significant only for those who have political connections ($p < 0.01$). One possible line of intuition is that borrowers with larger possession of financial assets are relatively wealthier. If they have taken a loan with financial assets as security, they are more likely to repay to avoid losing their asset in the event of default. This is more likely be the case if they have political connections such that these induce them to repay. Size of land ownership is insignificant for loan repayment irrespective of the treatment status. Higher age of the household head is associated with a higher probability of loan repayment for the control

group ($p < 0.01$). The higher the education level of any household member, higher is the likelihood of repayment. This is significant for those without political connections ($p < 0.05$).

So far as occupation status of the household is concerned, it is the low income worker class who are less likely to repay compared with the cultivator and allied class (the base group), but this is significant only for the borrowers who are politically connected ($p < 0.01$). Though the coefficient is negative for the salaried and others, it is not significant. This is intuitive because politicians are likely to waive loans of the relatively poorer section of the society in order to increase their vote base, and it is the weaker section whose votes are cheaper to buy (Bhattacharya et al., 2017). Higher consumption expenditure reduces the probability of repayment for the control group ($p < 0.01$) but as we control for additional variables in specifications 2 and 3, the coefficient becomes positive and significant at 10% for the control group. Religion and caste have no significant association with the repayment probability of borrowers, regardless of whether they have political connections or not.

Households belonging to urban areas are significantly more likely to repay their loan vis-a-vis the rural borrowers. This holds both for the treated group ($p < 0.1$) and for the control group ($p < 0.05$). If a household has experienced any shock, it is less likely to repay its loan than if otherwise, regardless of whether or not it has political connections. Idiosyncratic shocks which are specific to a particular household lead to huge loss of expenditure and thus may lower repayment probability of households. But, it more significant for those who are politically unconnected ($p < 0.01$) than it is for the treated group ($p < 0.05$). Having a life or a health insurance or both increases repayment probability of borrowers. But it is significant for those without political connections ($p < 0.05$).

The size of the largest loan and the source of this loan have the same sign across both the treated and control groups. Higher loan size lowers the probability of repayment as it implies a higher repayment burden on the borrower ($p < 0.1$). If the largest loan of the household comes from the formal sector, it is less likely to repay it than if it took an informal loan ($p < 0.1$ and $p < 0.05$ respectively). This result is consistent with the previous studies which suggest that informal lenders have the means to monitor borrower's actions and enforce repayment by forceful means if required, but this is not the case with formal lenders. Loans obtained for productive projects are associated with a significantly higher probability of repayment than unproductive loans for the control group ($p < 0.05$). We also find that the households who have taken a single loan are more likely to repay than those that have taken multiple loans ($p < 0.1$) which is true for the treated group.

The social network variables have different effects on the likelihood of repayment by borrowers. Membership in credit associations reduce the probability of repayment for the politically unconnected households ($p < 0.05$), while membership in social group increases repayment probability for this group ($p < 0.05$). However, so far as participation in public meetings is concerned, it reduces the repayment probability significantly for the politically connected borrowers ($p < 0.05$).

5.4.3 Exploring channel(s) between political network and repayment

We have found a significant association between political connections and loan repayment in the previous sub-section. This observed relationship may be driven by a third intervening variable, and if this is the case, the causal relationship between the treatment variable and the outcome variable need not be true. We suspect that one source by which political connections may positively affect loan repayment is by way of enabling access to various schemes of the government, for example, insurance and housing schemes. These schemes bring in monetary resources and may help borrowers to repay their loan. To examine if governmental schemes act as a channel between political network and repayment, we adopt the approach of Baron and Kenny (1986) to carry out a mediation analysis using governmental schemes as the mediator variable (M) which we suspect may be driving the observed relationship between political network(X) and repayment(Y). This approach is best suited in cases where a strong association between the predictor (independent) variable and the criterion (dependent) variable is observed (Baron & Kenny, 1986)⁹. This approach involves four distinct steps to establish the mediation hypothesis (Mehmetoglu, 2018). First, we regress the dependent variable (loan repayment) on the independent variable (political network) and this path (α_1) should be statistically significant suggesting that there is an effect to be mediated. Second, we regress the hypothesized mediator (government schemes) on political network and this path (β_1) must be statistically significant indicating the evidence of a relationship between the two. Third, we regress loan repayment on government schemes (controlling for political network) and this path (α_2) should be statistically significant. It is recommended that we should include the independent variable in this model because the mediator and the dependent variables may be correlated because both are caused by the independent variable. This procedure provides us with the new path α_1^* between political network and loan repayment. The fourth condition requires that the path α_1^*

⁹Recent applications of this method include Mehmetoglu (2018) and U. Bose, Arun, and Arun (2021).

is 0, which essentially means that mediator (M) completely mediates the association between the independent variable (X) and the dependent variable (Y). However, if only the first three conditions are fulfilled and the last one is not met, there is evidence of partial mediation.

Following the above, we estimate the following sets of equations. Equations (1) and (2) involves the first two steps as explained above. Equation (4) pertains to step 3 above where loan repayment is regressed on both political network and government schemes. We estimate the same treatment effect model augmented with IV framework as before. However, we estimate another equation (3) in which we regress loan repayment on the mediator variable government schemes but do not control for political network (a probit model). This is only to check whether there exists any significant relationship between the mediator and the dependent variable without accounting for the independent variable. The inclusion of this additional step does not affect the mediation results since these are all distinct steps.

$$loanrep_i^j = \alpha_0 + \alpha_1 pol.network_i + \alpha_2 X_i + \delta_{s,i} + \mu_{ij}, j = \{0, 1\}.....(1)$$

$$gouv.schemes_i^j = \beta_0 + \beta_1 pol.network_i + \beta_2 X_i + \delta_{s,i} + \mu_{ij}, j = \{0, 1\}.....(2)$$

$$loanrep_i = \gamma_0 + \gamma_1 gouv.schemes_i + \gamma_2 X_i + \delta_{s,i} + \mu_i.....(3)$$

$$loanrep_i^j = \alpha_0 + \alpha_1^* pol.network_i + \alpha_2 gouv.schemes_i + \alpha_3 X_i + \delta_{s,i} + \mu_{ij}, j = \{0, 1\}....(4)$$

In table 6 below, we present the results of the mediation analysis¹⁰. We first provide the estimate of the ATET followed by ATE. We include all the control variables and state fixed effects while estimating each equation. It is evident from the table that the paths (α_1) and (β_1) both are significant and positive ($p < 0.05$ and $p < 0.1$) and hence the first two conditions are satisfied. It suggests that politically connected households have a higher probability of repaying their loan relative to the control group. Further, households with political connections are more likely to get access to governmental schemes. This is intuitive because politicians and panchayat officials often influence beneficiary selection to many public welfare schemes, and are likely to favour their close contacts and/or relatives. Further, we find a significant and negative association between and government schemes ($p < 0.05$) and loan repayment. This suggests that borrower households who have access to governmental schemes are less likely to repay their loan vis-a-vis those without these schemes. This result points towards some evidence of clientelism in the sense that borrowers with access to these schemes have a tendency to default. Coming to the final step, the estimates of equation (4) indicates that when government scheme

¹⁰The complete results of this model are presented in table 6A in the appendix

is controlled, political network continues to have a significant and positive effect on loan repayment ($p < 0.05$), with a larger magnitude than before ($0.1610 > 0.1561$). The coefficient of government schemes (path α_2) on loan repayment is negative and significant ($p < 0.05$) and it is significant for the control group only. This shows that the third step is fulfilled. However, the fourth condition is not met in this case because the coefficient of political network on repayment (α_1^*) is significant. Thus, we can say that government schemes partially mediates the relation between political connections and loan repayment. We find similar results for the ATE.

Table 6. Mediation analysis (ATET)

Independent variable	Dependent variable			
	Loan repaid (Y) (Step 1)	Govt. schemes (M) (Step 2)	Loan repaid (Y) (Step 3)	Loan repaid (Y) (Step 4)
Political network (X)	0.1561** (0.0685)	0.1882* (0.0976)		0.1610** (0.0655)
Govt. schemes (control)			-0.0807** (0.0338)	-0.0984** (0.0431)
Govt. schemes (treated)			-0.0807** (0.0338)	-0.0301 (0.0546)
All control variables	yes	yes	yes	yes
State fixed effects	yes	yes	yes	yes

Notes: This table presents the ATET of political network on loan repayment via the channel of governmental schemes. Four models are estimated one by one. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Table 6. Mediation analysis (ATE)

Independent variable	Dependent variable			
	Loan repaid (Y) (Step 1)	Govt. schemes (M) (Step 2)	Loan repaid (Y) (Step 3)	Loan repaid (Y) (Step 4)
Political network (X)	0.3876** (0.1556)	0.3226** (0.1476)		0.3920** (0.1541)
Govt. schemes (control)			-0.0807** (0.0338)	-0.0984** (0.0431)
Govt. schemes (treated)			-0.0807** (0.0338)	-0.0301 (0.0546)
All control variables	yes	yes	yes	yes
State fixed effects	yes	yes	yes	yes

Notes: This table presents the ATE of political network on loan repayment via the channel of governmental schemes. Four models are estimated one by one. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Results from the mediation analysis indicate that clientelism in a direct form is absent, but if we observe this relationship through governmental schemes, there is some evidence of political clientelism. In step 3 in table 6, we see that access to government schemes lower repayment probabilities for all, irrespective of their treatment status. However, as the overall repayment

performance is higher with connections, there could be some other channels to consider. If the coefficient of government schemes on loan repayment were positive and significant, we could conclude that it is through these schemes that political connections help borrowers repay their loan. But, we get a negative effect of the mediator variable on repayment which is significant. This together with the finding that the positive effect of connections on repayment is maintained after the mediator is controlled for points out that there is limited evidence of political clientelism in the Indian context, and we cannot exactly rule out the mediating effect of government schemes. As Baron and Kenny (1986) suggest, when a significant relationship between the dependent and independent variables is not eliminated completely, one may conclude that the mediator is important, but it is not both a necessary and a sufficient condition for an effect to occur.

5.4.4 Robustness of results with different types of coarsening

We check whether our results are sensitive to the type of coarsening chosen. If the treatment effects (ATET and ATE) are same no matter what coarsening we choose, then we can say that the results are robust and there is a causal effect of political connections on loan repayment of households. In table 7 below, we present treatment effects against different levels of coarsening. We consider six specifications (Model A, Model B, Model C, Model D, Model E and Model F), one by one, where we add variables and change the cut-off points to coarsen the data to match observations between the treated and the control groups. We start with the primary occupation type and the annual income of the household. Since occupation is a categorical variable, the default coarsening is chosen. In Model A, we partition income into 6 bins such that we have an equal number of observations in each bin. Similarly, in Model B, we increase the numbers of bins to 8 to have uniform number of households in each bin. Likewise, we choose bins for other variables following the same argument. In table 7, the second and third columns corresponding to a particular coarsening represents the number of observations matched from the treated group and from the control group respectively out of the total sample. From Model A, we find that both the ATET and ATE are positive and significant. These are similar to the treatment effects found earlier in table 5. In Model B, we increase the cut-off points for income and find that the results are being preserved.

Next, in Model C and in Model D, we add gender of the household head and the age of

Table 7. Treatment effects under alternative coarsening procedures

Coarsening details	Treated (matched)	Control (matched)	ATET	ATE
Model A. Occupation				
	7715	14432	0.1408*	0.3896**
Income (-867.025 0 2000 5000 8000 11360)			(0.0725)	(0.1543)
Model B. Occupation				
	7713	14431	0.1411*	0.3895**
Income (-867.025 0 2000 3000 5000 7000 9000 11360)			(0.0723)	(0.1544)
Model C. Occupation, male head				
Income (-867.025 0 2000 5000 8000 11360)	7711	14416	0.1412*	0.3856**
			(0.0734)	(0.1566)
Age head (15 30 60 99)				
Model D. Occupation, male head				
Income (-867.025 0 2000 3000 5000 7000 9000 11360)	7703	14408	0.1429**	0.3878**
			(0.0727)	(0.1560)
Age head (15 25 50 60 99)				
Model E. Occupation, male head, loan purpose productive				
Income (-867.025 0 2000 5000 8000 11360)				
	7696	14360	0.1237	0.3784**
Age head (15 30 60 99)			(0.0856)	(0.1563)
Log loan size (3.91 9.9 11.51 18.133)				
Model F. Occupation, male head, loan purpose productive				
Income (-867.025 0 2000 3000 5000 7000 9000 11360)				
	7678	14298	0.1561**	0.3876**
Age head (15 25 50 60 99)			(0.0685)	(0.1556)
Log loan size (3.91 9.15 9.9 10.7 11.51 18.133)				
Total sample size	7717	14432		

Notes: This table presents the treatment effects with different types of coarsening. Starting with two variables, more variables are added and the cut-off points changed to match observations between the treated and control groups in the subsequent specifications. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

the head and consider different cut-offs and find similar results. In Model E, we further add loan size and the loan purpose dummy to the previous specification. We find that this time the treatment effect of political network on the sample of the treated (ATET) is not significant, though positive. However, the ATE is positive and significant as before. Finally, in Model F, we change (increase) the cut-off points for income, age of head and loan size and the default coarsening is chosen for the categorical variables. We find that both the ATET and ATE are positive and significant. We note that this is the coarsening type that we have chosen earlier (in table 5) to estimate the causal effect. Thus, we start with one type of coarsening and find

that the results are maintained as we keep on varying the coarsening procedure. Hence, our model results are robust and are not driven by the specific type of coarsening method adopted. We present the complete results for each model in tables 7A and 7B in the appendix.

5.4.5 Estimating causal effect of political network by land ownership status

There is a perception in the literature that there is a close link between the way political clientelism operates and the wealth position of people. Land is one such asset with which clientelism has been found to be frequently associated. Bardhan and Mookherjee(2017) in their review paper suggest that political clientelism tends to be in favor of poor voters as their votes are cheaper to buy. There is another strand of literature which finds that politically connected households are able to do more land related investments, facilitated through their preferential access to credit due to possession of these networks(Hussain & Tyagi, 2020; Markussen & Tarp, 2014). Land allocation allows politicians to maintain a long-term patron-client relationship and this possibility increases all the more in a democracy(Dyzenhaus, 2021). Given these evidences, the importance of political connections in loan repayment could also vary according to land ownership status of borrowers. The landless constitute about 50.80% of the borrowers in our sample. Our data reveals that among the politically connected, the fraction of households with positive land ownership is almost thrice that of the landless (26%). This pattern is similar to the findings in the literature that connections with influential people facilitate land investments for the households. Thus, an obvious question arises whether it is the borrowers with land ownership or relatively higher land ownership who can take advantage of political connections while repaying their loan vis-à-vis the landless or the marginal land owners, for example. Given that there exists huge disparity in size of land ownership in India, we consider different categories of land owning classes and examine for which segment political connections actually matter in loan repayment.

To address this question, we construct four dummy variables in separate specifications: landed, small & above, semi-medium & above and medium & above, following the definitions of land ownership given in the report of the Ministry of Agriculture and Farmers Welfare, Government of India. These are defined in table 1 above. The reference groups are defined accordingly. Table 2 reveals that the proportion of small & above borrowers (owning more than 2.47 acres of land) in the sample is 36.2%. The corresponding figure for semi-medium & above group (owning more than 4.94 acres of land) is 24.8% and that for medium & above category (owning

more than 9.88 acres of land) is 13.1%. We estimate the endogenous treatment effects model for each sub-sample separately. We exclude the land ownership variable in the regressions to avoid the problems of collinearity.

Table 8. Heterogeneous treatment effects according to different categories of land ownership

Land ownership	ATET	ATE
landed	0.0230 (0.2279)	0.4623*** (0.0978)
landless	0.1550** (0.0757)	0.1296 (0.2341)
small & above	-0.0255 (0.3416)	0.4335*** (0.1510)
below small & above	0.1643** (0.0669)	0.2564 (0.2268)
semi-med & above	0.1895 (0.1189)	0.5030*** (0.0868)
below semi-med & above	0.1573** (0.0666)	0.2590 (0.2069)
medium & above	0.1819 (0.1681)	0.5129*** (0.0815)
below medium & above	0.1632*** (0.0578)	0.2842 (0.1881)

Notes: This table reports the ATET and ATE estimates of political network using a sub-sample of different categories of land ownership of borrowers. In the first specification, landed group is considered and the treatment effects are estimated vis-a-vis the landless, which is the reference group. Other specifications are considered accordingly. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

In Table 8, we present the treatment effect of political network on loan repayment by land ownership status. The coefficient of ATET suggests that the political connections have a positive and significant effect on repayment for the landless group ($p < 0.05$), but is insignificant for those owning some land. When we consider different categorizations of land, we find that the treatment effect of political network is positive and significant for the group in the lower end of the distribution, that is, those owning less than 2.47 acres, 4.94 acres and 9.88 acres in the respective specifications. Therefore, one may say that these connections are helpful for the relatively land poor borrowers in repaying their loan. It is not the resource rich borrowers who benefit from political connections.

On the other hand, the estimates of ATE present a slightly different story. Here the positive role of political connections is significantly evident in case of the landed class, those belonging to small & above, semi-medium & above and medium & above land owners in the respective models

considered. We may argue that since ATE is a weighted sum of the treatment effects for the treated group and for the control group, the positive and significant effect of political network may be driven by the presence of the control group. This indicates that in the counterfactual state, had the control group been given the treatment (political connections), their repayment performance would improve if they belong to the higher end of land distribution. In that case, it is the households who own land or are relatively land rich who would benefit significantly from their connections. The complete model results are given as separate tables 8A, 8B, 8C and 8D in the appendix.

5.5 Conclusion

The literature on political clientelism discusses the adverse consequences of political connections on the economy, resulting from the misallocation of resources away from the target audience. Subsidized credit is one such politically distributed good (Banerjee & Munshi, 2004; Maitra et al., 2021). When it comes to loan repayment by borrowers, there is some difference of opinion across the literature as to whether political connections increase or reduce the likelihood of repayment. While most studies examine the nexus between social network and repayment in case of group lending programs and of firms, there is a very scant literature on how political networks affect repayment performance of individual borrowers. The main focus of this study is, therefore, to examine the causal association between political connections of households and their repayment performance in case of India.

We conjecture that political connections may affect repayment in two distinct ways. On one hand, the chances of the project going bad is reduced with political connections if these bring in monetary resources or any other form of support leading to repayment. In cases when the project is a success, political connections may induce borrowers to repay, or in other words prevent the likelihood of strategic default. In that case, political network will have a positive effect on loan repayment. On the other hand, politically connected borrowers may have information regarding and may have easy access to upcoming loan waiver schemes of the government and hence choose not to repay their loan. Alternately, borrowers may take undue advantage of their connections and default strategically. This shall suggest a negative effect of political connections on repayment.

To address the non-random (endogenous) assignment to political network, the present study

combines matching with an instrumental variable (IV) framework. Results indicate that political connections significantly increase loan repayment probabilities for borrowers. We further explore channel(s) that could possibly mediate the relationship of interest. We find evidence that governmental schemes partially mediate the causal link between political network and repayment. We find that political connections facilitate access to welfare schemes of the government which could bring in monetary resources, however, such schemes only lower the chances of repayment. Thus, it is not entirely through governmental schemes that political connections increase repayment performance of borrowers. A sub-sample analysis with heterogeneous land ownership status of Indian households indicates that political connections have a positive and significant effect on loan repayment for the landless group and for borrowers in the lower end of the land distribution. This has an important policy implication. Lenders tend to assess credit worthiness of borrowers according to their size of land holdings. However, we show that the repayment probability is higher for the relatively land poor segment when they are politically connected. Thus, lenders may exploit information about social connections (e.g., political) of borrowers while offering loans as this can be a likely substitute for physical collateral. Overall, this study finds limited evidence of political clientelism in the Indian context, contrary to what the literature on clientelism suggests. Rather, it has a disciplining effect which improves repayment performance of households.

5.6 Appendix

Table 5A. Treatment model of political network using IPW estimator

land ownership	0.0006 (0.0011)	urban	-0.2850*** (0.0330)
physical asset index	-0.3034*** (0.0953)	idiosyncratic shock	0.0261 (0.0278)
financial asset index	0.1791*** (0.0687)	covariant shock	0.2049*** (0.0342)
log con exp	0.1037*** (0.0289)	any insurance	0.0483 (0.0311)
salaried and others	0.3116*** (0.0453)	singleloan	-0.0528* (0.0299)
low-income workers	0.2324*** (0.0366)	loan productive	0.0239 (0.0300)
HH size	-0.0133** (0.0064)	largest formal	0.0360 (0.0315)
male head	-0.0432 (0.0430)	log loan	-0.0337*** (0.0123)
age head	-0.0007 (0.0011)	member credit	0.0224 (0.0326)
highest educ	0.0098*** (0.0033)	member social group	0.1748*** (0.0455)
upper caste	-0.0814** (0.0347)	public meetings	0.5798*** (0.0316)
Hindu	0.0532 (0.0365)	constant	-1.5869*** (0.3411)
State fixed effects	yes		

Notes: This table presents the parameters of the treatment model of political network using inverse probability weighting estimator. The ipw weights generated are used to compute the average treatment effects of the base model given in table 5. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Table 5B. Reduced form model of political network

Variables	IV model 1	IV model 2	IV model 3
Years in place	0.0026*** (0.0006)	0.0026*** (0.0006)	0.0022*** (0.0006)
Moderate political confidence	0.1611*** (0.0393)	0.1596*** (0.0392)	0.1261*** (0.0398)
High political confidence	0.2787*** (0.0472)	0.2775*** (0.0470)	0.2197*** (0.0478)
land ownership	0.0005 (0.0012)	0.0006 (0.0012)	0.0005 (0.0011)
physical asset index	-0.3780*** (0.0994)	-0.3563*** (0.0983)	-0.2969*** (0.0961)
financial asset index	0.2575*** (0.0674)	0.2595*** (0.0680)	0.1782** (0.0692)
log con exp	0.1107*** (0.0290)	0.1382*** (0.0294)	0.1118*** (0.0292)
salaried and others	0.2881*** (0.0458)	0.2962*** (0.0463)	0.3218*** (0.0456)
low-income workers	0.2429*** (0.0360)	0.2428*** (0.0368)	0.2402*** (0.0369)
HH size	-0.0140** (0.0065)	-0.0151** (0.0065)	-0.0150** (0.0064)
male head	0.0177 (0.0424)	0.0131 (0.0426)	-0.0410 (0.0430)
age head	-0.0007 (0.0011)	-0.0005 (0.0011)	-0.0008 (0.0011)
highest educ	0.0117*** (0.0032)	0.0121*** (0.0032)	0.0101*** (0.0033)
upper caste	-0.1064*** (0.0349)	-0.1012*** (0.0350)	-0.0840** (0.0349)
Hindu	0.0360 (0.0371)	0.0347 (0.0371)	0.0505 (0.0367)

Table 5B. Reduced form model of political network (continued)

Variables	IV model 1	IV model 2	IV model 3
urban	-0.3648*** (0.0337)	-0.3584*** (0.0338)	-0.2487*** (0.0341)
idiosyncratic shock	0.0410 (0.0277)	0.0430 (0.0277)	0.0293 (0.0279)
covariant shock	0.2315*** (0.0341)	0.2320*** (0.0341)	0.2034*** (0.0344)
any insurance	0.0828*** (0.0308)	0.0814*** (0.0308)	0.0481 (0.0313)
single loan		-0.0745** (0.0295)	-0.0586* (0.0301)
loan productive		0.0279 (0.0295)	0.0212 (0.0301)
largest formal		0.0481 (0.0308)	0.0371 (0.0316)
log loan		-0.0399*** (0.0121)	-0.0324*** (0.0124)
member credit			0.0259 (0.0326)
member social group			0.1665*** (0.0462)
public meetings			0.5680*** (0.0318)
constant	-2.2510*** (0.3571)	-2.1751*** (0.3585)	-1.9590*** (0.3500)
State fixed effects	yes	yes	yes

Notes. This table provides the estimates from the reduced form equation of the endogenous treatment variable political network. It is regressed on the instruments and the covariates from the outcome model. We fit three models where more variables are controlled for in the subsequent specifications.

Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Table 5C. Probit estimates of covariates on loan repayment according to treatment status

Variables	IV model 1		IV model 2		IV model 3	
	Treated	Control	Treated	Control	Treated	Control
land ownership	-0.0030 (0.0019)	-0.0022 (0.0016)	-0.0002 (0.0016)	0.0001 (0.0015)	-0.0001 (0.0016)	0.0000 (0.0015)
physical asset index	0.3851** (0.1804)	0.1069 (0.1094)	0.5004*** (0.1744)	0.3270*** (0.1116)	0.4462*** (0.1673)	0.2968*** (0.1089)
financial asset index	0.1478 (0.1399)	-0.0990 (0.0896)	0.3732*** (0.1368)	0.0459 (0.0916)	0.4316*** (0.1311)	0.0453 (0.0877)
HH size	0.0230* (0.0122)	0.0032 (0.0084)	0.0127 (0.0121)	-0.0028 (0.0087)	0.0133 (0.0121)	-0.0022 (0.0087)
male head	0.0062 (0.0835)	0.0187 (0.0560)	0.0150 (0.0833)	0.0050 (0.0592)	0.0490 (0.0830)	0.0075 (0.0601)
age head	-0.0004 (0.0021)	0.0025* (0.0014)	0.0016 (0.0020)	0.0040*** (0.0014)	0.0017 (0.0020)	0.0039*** (0.0014)
salaried and others	-0.1561 (0.1068)	0.1359** (0.0677)	-0.1300 (0.1077)	0.1132 (0.0697)	-0.1411 (0.1160)	0.1111 (0.0723)
low-income workers	-0.2086** (0.0881)	0.0228 (0.0581)	-0.2456*** (0.0881)	-0.0566 (0.0600)	-0.2380*** (0.0903)	-0.0501 (0.0597)
log con exp	-0.2877*** (0.0590)	-0.1310*** (0.0389)	-0.0520 (0.0621)	0.0744* (0.0444)	-0.0315 (0.0598)	0.0833* (0.0428)
highest educ	-0.0127** (0.0065)	0.0023 (0.0041)	-0.0047 (0.0065)	0.0095** (0.0042)	-0.0030 (0.0064)	0.0096** (0.0042)
Hindu	0.0463 (0.0718)	-0.0088 (0.0449)	0.0783 (0.0706)	-0.0076 (0.0457)	0.0740 (0.0708)	-0.0031 (0.0460)
upper caste	-0.0268 (0.0662)	0.0358 (0.0439)	-0.0110 (0.0631)	0.0660 (0.0440)	-0.0237 (0.0621)	0.0646 (0.0429)

Table 5C. Probit estimates of covariates on loan repayment according to treatment status(continued)

Variables	IV model 1		IV model 2		IV model 3	
	Treated	Control	Treated	Control	Treated	Control
urban	0.3445*** (0.1169)	0.1479** (0.0706)	0.2671** (0.1146)	0.1424** (0.0717)	0.1850* (0.0969)	0.1163** (0.0584)
idiosyncratic shock	-0.1069** (0.0527)	-0.1184*** (0.0345)	-0.1114** (0.0527)	-0.0913** (0.0357)	-0.1051** (0.0521)	-0.0926*** (0.0356)
covariant shock	-0.1846** (0.0848)	-0.0156 (0.0574)	-0.1383 (0.0845)	0.0047 (0.0588)	-0.1122 (0.0804)	0.0114 (0.0552)
any insurance	-0.0441 (0.0595)	0.0563 (0.0400)	-0.0067 (0.0579)	0.0736* (0.0410)	0.0166 (0.0557)	0.0787** (0.0400)
log loan			-0.2463*** (0.0245)	-0.2615*** (0.0181)	-0.2546*** (0.0242)	-0.2661*** (0.0177)
largest formal			-0.1978*** (0.0604)	-0.1234*** (0.0417)	-0.1756*** (0.0601)	-0.1034** (0.0417)
loan productive			0.0642 (0.0556)	0.0877** (0.0391)	0.0660 (0.0556)	0.0868** (0.0390)
single loan			0.1250** (0.0576)	0.0040 (0.0390)	0.1074* (0.0568)	-0.0031 (0.0386)
member credit					-0.0874 (0.0565)	-0.0915** (0.0444)
member social group					-0.0366 (0.0810)	0.1148** (0.0560)
public meetings					-0.3671** (0.1638)	-0.0885 (0.0990)
constant	4.3613*** (1.0378)	0.6724 (0.4226)	3.4182*** (1.0002)	0.7144 (0.4367)	3.2705*** (1.0129)	0.6708 (0.4363)
State fixed effects	yes	yes	yes	yes	yes	yes

Notes: This table presents the coefficients of the covariates on the probability of loan repayment. We estimate three specifications where we control for more variables as we move from IV model 1 to IV model 2 to IV model 3.

Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

Table 6A. Mediation analysis estimates of covariates

	(Step 1)		(Step 2)		(Step 3)	(Step 4)	
Variables	treated	control	treated	control		treated	control
land ownership	-0.0001 (0.0016)	0.0000 (0.0015)	0.0027* (0.0015)	0.0030* (0.0016)	0.0003 (0.0011)	-0.0001 (0.0016)	0.0001 (0.0015)
phy asset index	0.4462*** (0.1673)	0.2968*** (0.1089)	-0.2545 (0.1594)	-0.0031 (0.1141)	0.2489*** (0.0810)	0.4431*** (0.1675)	0.2970*** (0.1086)
fin asset index	0.4316*** (0.1311)	0.0453 (0.0877)	-0.1144 (0.1268)	-0.0716 (0.0934)	0.2558*** (0.0672)	0.4301*** (0.1311)	0.0405 (0.0878)
HH size	0.0133 (0.0121)	-0.0022 (0.0087)	0.0137 (0.0113)	0.0252*** (0.0091)	-0.0003 (0.0067)	0.0134 (0.0121)	-0.0013 (0.0087)
male head	0.0490 (0.0830)	0.0075 (0.0601)	0.0471 (0.0790)	0.0229 (0.0581)	0.0046 (0.0473)	0.0488 (0.0831)	0.0083 (0.0604)
age head	0.0017 (0.0020)	0.0039*** (0.0014)	0.0086*** (0.0019)	0.0069*** (0.0013)	0.0029*** (0.0011)	0.0018 (0.0020)	0.0041*** (0.0014)
salaried and others	-0.1411 (0.1160)	0.1111 (0.0723)	-0.3065*** (0.1131)	-0.2516*** (0.0688)	0.1169** (0.0460)	-0.1440 (0.1161)	0.1033 (0.0724)
low-income workers	-0.2380*** (0.0903)	-0.0501 (0.0597)	-0.1968** (0.0839)	-0.1081** (0.0548)	-0.0458 (0.0383)	-0.2400*** (0.0904)	-0.0532 (0.0598)
log con exp	-0.0315 (0.0598)	0.0833* (0.0428)	-0.1541*** (0.0555)	-0.1520*** (0.0393)	0.0626** (0.0307)	-0.0330 (0.0598)	0.0778* (0.0428)
highest educ	-0.0030 (0.0064)	0.0096** (0.0042)	0.0002 (0.0060)	-0.0052 (0.0044)	0.0090*** (0.0033)	-0.0030 (0.0065)	0.0095** (0.0042)
Hindu	0.0740 (0.0708)	-0.0031 (0.0460)	-0.0768 (0.0747)	0.0853* (0.0487)	0.0356 (0.0370)	0.0733 (0.0709)	-0.0015 (0.0460)
upper caste	-0.0237 (0.0621)	0.0646 (0.0429)	-0.1154* (0.0630)	-0.0753 (0.0487)	0.0094 (0.0336)	-0.0251 (0.0622)	0.0625 (0.0429)

Table 6A. Mediation analysis estimates of covariates (continued)

	(Step 1)		(Step 2)		(Step 3)	(Step 4)	
Variables	treated	control	treated	control		treated	control
urban	0.1850*	0.1163**	-0.2782***	-0.3377***	0.0434	0.1833*	0.1090*
	(0.0969)	(0.0584)	(0.0938)	(0.0588)	(0.0334)	(0.0969)	(0.0586)
log loan	-0.2546***	-0.2661***	0.0200	0.0295*	-0.2719***	-0.2543***	-0.2650***
	(0.0242)	(0.0177)	(0.0225)	(0.0173)	(0.0133)	(0.0242)	(0.0177)
largest formal	-0.1756***	-0.1034**	0.3143***	0.3967***	-0.1010***	-0.1730***	-0.0931**
	(0.0601)	(0.0417)	(0.0578)	(0.0423)	(0.0335)	(0.0607)	(0.0420)
loan productive	0.0660	0.0868**	0.0217	-0.0349	0.0849***	0.0660	0.0859**
	(0.0556)	(0.0390)	(0.0523)	(0.0388)	(0.0310)	(0.0556)	(0.0390)
single loan	0.1074*	-0.0031	-0.0149	0.0073	0.0197	0.1071*	-0.0026
	(0.0568)	(0.0386)	(0.0557)	(0.0409)	(0.0304)	(0.0569)	(0.0385)
idiosyncratic shock	-0.1051**	-0.0926***	-0.0119	-0.0210	-0.0751***	-0.1053**	-0.0932***
	(0.0521)	(0.0356)	(0.0492)	(0.0372)	(0.0285)	(0.0521)	(0.0356)
covariant shock	-0.1122	0.0114	0.1521**	0.1674***	0.0390	-0.1110	0.0160
	(0.0804)	(0.0552)	(0.0767)	(0.0536)	(0.0359)	(0.0804)	(0.0552)
any insurance	0.0166	0.0787**	1.0246***	0.9211***	0.0984***	0.0267	0.1076**
	(0.0557)	(0.0400)	(0.0527)	(0.0414)	(0.0329)	(0.0572)	(0.0424)
member credit	-0.0874	-0.0915**	0.0899	0.0860**	-0.0842**	-0.0864	-0.0885**
	(0.0565)	(0.0444)	(0.0566)	(0.0434)	(0.0342)	(0.0565)	(0.0445)
member social group	-0.0366	0.1148**	0.0120	0.1505***	0.1056***	-0.0366	0.1179**
	(0.0810)	(0.0560)	(0.0806)	(0.0579)	(0.0393)	(0.0811)	(0.0560)
public meetings	-0.3671**	-0.0885	-0.0839	-0.0426	0.0061	-0.3685**	-0.0919
	(0.1638)	(0.0990)	(0.1631)	(0.0997)	(0.0319)	(0.1637)	(0.0990)
constant	3.2705***	0.6708	0.3699	-0.5517	1.1634***	3.2912***	0.7062
	(1.0129)	(0.4363)	(0.9641)	(0.4460)	(0.3477)	(1.0131)	(0.4366)
State fixed effects	yes	yes	yes	yes	yes	yes	yes

Notes: This table presents the complete results of the models estimated in the four step process in the mediation analysis of governmental schemes on the probability of loan repayment. Four models are estimated one by one. Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Table 7A. Probit estimates of covariates on loan repayment for the treated group

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
land ownership	-0.0002 (0.0015)	-0.0002 (0.0015)	-0.0001 (0.0015)	-0.0005 (0.0016)	0.0002 (0.0015)	-0.0001 (0.0016)
phy asset index	0.4124*** (0.1587)	0.4124*** (0.1586)	0.4101*** (0.1580)	0.4103** (0.1593)	0.4310*** (0.1625)	0.4462*** (0.1673)
fin asset index	0.4239*** (0.1313)	0.4240*** (0.1313)	0.4298*** (0.1303)	0.4257*** (0.1309)	0.4242*** (0.1307)	0.4316*** (0.1311)
HH size	0.0124 (0.0120)	0.0124 (0.0120)	0.0127 (0.0120)	0.0126 (0.0120)	0.0131 (0.0121)	0.0133 (0.0121)
male head	0.0253 (0.0815)	0.0253 (0.0815)	0.0486 (0.0826)	0.0507 (0.0827)	0.0409 (0.0826)	0.0490 (0.0830)
age head	0.0016 (0.0020)	0.0016 (0.0020)	0.0018 (0.0020)	0.0022 (0.0020)	0.0017 (0.0020)	0.0017 (0.0020)
salaried and others	-0.1468 (0.1160)	-0.1463 (0.1160)	-0.1415 (0.1156)	-0.1438 (0.1163)	-0.1434 (0.1160)	-0.1411 (0.1160)
low-income workers	-0.2564*** (0.0961)	-0.2561*** (0.0960)	-0.2519*** (0.0948)	-0.2530*** (0.0946)	-0.2452*** (0.0916)	-0.2380*** (0.0903)
log con exp	-0.0345 (0.0599)	-0.0345 (0.0599)	-0.0349 (0.0598)	-0.0351 (0.0599)	-0.0350 (0.0599)	-0.0315 (0.0598)
highest educ	-0.0031 (0.0065)	-0.0031 (0.0065)	-0.0032 (0.0065)	-0.0031 (0.0065)	-0.0032 (0.0065)	-0.0030 (0.0064)
Hindu	0.0668 (0.0707)	0.0668 (0.0707)	0.0658 (0.0706)	0.0649 (0.0707)	0.0689 (0.0704)	0.0740 (0.0708)
upper caste	-0.0262 (0.0616)	-0.0265 (0.0615)	-0.0285 (0.0616)	-0.0296 (0.0617)	-0.0281 (0.0616)	-0.0237 (0.0621)

Table 7A. Probit estimates of covariates on loan repayment for the treated group (continued)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
urban	0.1966** (0.0982)	0.1964** (0.0981)	0.1919* (0.0981)	0.1926* (0.0984)	0.1909** (0.0973)	0.1850* (0.0969)
log loan	-0.2513*** (0.0243)	-0.2513*** (0.0243)	-0.2516*** (0.0243)	-0.2514*** (0.0244)	-0.2503*** (0.0246)	-0.2546*** (0.0242)
largest formal	-0.1811*** (0.0601)	-0.1812*** (0.0601)	-0.1818*** (0.0602)	-0.1798*** (0.0601)	-0.1804*** (0.0601)	-0.1756*** (0.0601)
loan productive	0.0547 (0.0562)	0.0546 (0.0563)	0.0570 (0.0560)	0.0564 (0.0563)	0.0642 (0.0553)	0.0660 (0.0556)
single loan	0.1012* (0.0564)	0.1011* (0.0564)	0.1016* (0.0564)	0.1017* (0.0564)	0.1065* (0.0569)	0.1074* (0.0568)
idiosyncratic shock	-0.1102** (0.0520)	-0.1101** (0.0519)	-0.1106** (0.0519)	-0.1097** (0.0520)	-0.1108** (0.0519)	-0.1051** (0.0521)
covariant shock	-0.1172 (0.0826)	-0.1172 (0.0826)	-0.1157 (0.0828)	-0.1155 (0.0823)	-0.1132 (0.0816)	-0.1122 (0.0804)
any insurance	0.0190 (0.0555)	0.0190 (0.0554)	0.0181 (0.0555)	0.0195 (0.0555)	0.0197 (0.0556)	0.0166 (0.0557)
member credit	-0.0816 (0.0559)	-0.0815 (0.0559)	-0.0828 (0.0560)	-0.0826 (0.0561)	-0.0821 (0.0562)	-0.0874 (0.0565)
member social group	-0.0324 (0.0802)	-0.0319 (0.0801)	-0.0336 (0.0802)	-0.0336 (0.0806)	-0.0325 (0.0800)	-0.0366 (0.0810)
public meetings	-0.3688** (0.1628)	-0.3684** (0.1627)	-0.3654** (0.1633)	-0.3687** (0.1638)	-0.3643** (0.1618)	-0.3671** (0.1638)
constant	3.3893*** (1.0375)	3.3887*** (1.0378)	3.3446*** (1.0209)	3.3366*** (1.0165)	3.3298*** (1.0111)	3.2705*** (1.0129)
State fixed effects	yes	yes	yes	yes	yes	yes

Notes: This table presents the estimates of the covariates on the probability of loan repayment for the treated group based on different types of coarsening chosen. Six models are estimated as shown in table 7 above.

Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source IHDS-2, 2011-12.

Table 7B. Probit estimates of covariates on loan repayment for the control group

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
land ownership	-0.0002 (0.0015)	-0.0002 (0.0015)	-0.0001 (0.0015)	0.0001 (0.0015)	0.0003 (0.0014)	0.0000 (0.0015)
phy asset index	0.2883*** (0.1009)	0.2870*** (0.1008)	0.2981*** (0.1007)	0.3053*** (0.1012)	0.2841*** (0.1050)	0.2968*** (0.1089)
fin asset index	0.0669 (0.0857)	0.0658 (0.0857)	0.0625 (0.0857)	0.0580 (0.0858)	0.0573 (0.0870)	0.0453 (0.0877)
HH size	-0.0049 (0.0084)	-0.0049 (0.0084)	-0.0053 (0.0084)	-0.0052 (0.0084)	-0.0056 (0.0085)	-0.0022 (0.0087)
male head	0.0096 (0.0563)	0.0095 (0.0563)	0.0221 (0.0568)	0.0129 (0.0572)	0.0169 (0.0577)	0.0075 (0.0601)
age head	0.0036*** (0.0013)	0.0036*** (0.0013)	0.0039*** (0.0013)	0.0040*** (0.0014)	0.0040*** (0.0014)	0.0039*** (0.0014)
salaried and others	0.1285* (0.0701)	0.1283* (0.0701)	0.1242* (0.0701)	0.1130 (0.0707)	0.1366* (0.0708)	0.1111 (0.0723)
low-income workers	-0.0486 (0.0599)	-0.0485 (0.0599)	-0.0539 (0.0595)	-0.0524 (0.0596)	-0.0344 (0.0591)	-0.0501 (0.0597)
log con exp	0.0823** (0.0415)	0.0819** (0.0415)	0.0839** (0.0419)	0.0785* (0.0419)	0.0899** (0.0414)	0.0833* (0.0428)
highest educ	0.0095** (0.0041)	0.0095** (0.0041)	0.0093** (0.0041)	0.0097** (0.0041)	0.0103** (0.0041)	0.0096** (0.0042)
Hindu	-0.0131 (0.0447)	-0.0132 (0.0447)	-0.0176 (0.0448)	-0.0156 (0.0449)	-0.0093 (0.0446)	-0.0031 (0.0460)
upper caste	0.0444 (0.0420)	0.0448 (0.0420)	0.0419 (0.0421)	0.0468 (0.0422)	0.0491 (0.0426)	0.0646 (0.0429)

Table 7B. Probit estimates of covariates on loan repayment for the control group (continued)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
urban	0.1090*	0.1094*	0.1126**	0.1167**	0.1090*	0.1163**
	(0.0563)	(0.0562)	(0.0566)	(0.0570)	(0.0563)	(0.0584)
log loan	-0.2649***	-0.2647***	-0.2661***	-0.2644***	-0.2719***	-0.2661***
	(0.0176)	(0.0176)	(0.0176)	(0.0175)	(0.0179)	(0.0177)
largest formal	-0.0968**	-0.0968**	-0.1035**	-0.1032**	-0.0856**	-0.1034**
	(0.0404)	(0.0404)	(0.0408)	(0.0408)	(0.0414)	(0.0417)
loan productive	0.0798**	0.0796**	0.0869**	0.0837**	0.0914**	0.0868**
	(0.0381)	(0.0381)	(0.0381)	(0.0382)	(0.0382)	(0.0390)
single loan	-0.0183	-0.0179	-0.0177	-0.0149	-0.0237	-0.0031
	(0.0372)	(0.0372)	(0.0373)	(0.0373)	(0.0380)	(0.0386)
idiosyncratic shock	-0.0819**	-0.0815**	-0.0836**	-0.0790**	-0.0821**	-0.0926***
	(0.0346)	(0.0346)	(0.0346)	(0.0346)	(0.0348)	(0.0356)
covariant shock	0.0254	0.0259	0.0186	0.0163	0.0297	0.0114
	(0.0536)	(0.0536)	(0.0539)	(0.0534)	(0.0558)	(0.0552)
any insurance	0.0943**	0.0946**	0.0929**	0.0938**	0.0863**	0.0787**
	(0.0387)	(0.0387)	(0.0386)	(0.0387)	(0.0393)	(0.0400)
member credit	-0.1064**	-0.1061**	-0.1074**	-0.1001**	-0.0985**	-0.0915**
	(0.0423)	(0.0423)	(0.0423)	(0.0424)	(0.0434)	(0.0444)
member social group	0.1023*	0.1010*	0.1048*	0.1005*	0.1216**	0.1148**
	(0.0538)	(0.0538)	(0.0544)	(0.0545)	(0.0544)	(0.0560)
public meetings	-0.0672	-0.0676	-0.0675	-0.0686	-0.0522	-0.0885
	(0.0934)	(0.0933)	(0.0940)	(0.0943)	(0.0971)	(0.0990)
constant	0.7118	0.7129	0.6815	0.7249*	0.6664	0.6708
	(0.4345)	(0.4347)	(0.4350)	(0.4343)	(0.4200)	(0.4363)
State fixed effects	yes	yes	yes	yes	yes	yes

Notes: This table presents the estimates of the covariates on the probability of loan repayment for the control group based on different types of coarsening chosen. Six models are estimated as shown in table 7 above.

Robust standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source IHDS-2, 2011-12.

Table 8A. Probit estimates of covariates on repayment for landed and landless

Variables	landed		landless	
	treated	control	treated	control
land ownership	-0.0003 (0.0021)	-0.0005 (0.0017)	0.0000 (.)	0.0000 (.)
phy asset index	0.5756* (0.3209)	0.0148 (0.1779)	0.4213* (0.2150)	0.4178*** (0.1173)
fin asset index	0.2481 (0.2491)	0.0816 (0.1422)	0.4285** (0.1776)	0.1491 (0.1010)
log con exp	-0.0797 (0.1006)	0.0898 (0.0678)	-0.0189 (0.0861)	0.0578 (0.0495)
salaried and others	0.0220 (0.1379)	0.3016*** (0.0889)	0.2005 (0.2144)	0.0757 (0.1449)
low-income workers	-0.1859* (0.0992)	0.0051 (0.0614)	0.0041 (0.2058)	-0.0586 (0.1401)
HH size	0.0162 (0.0196)	-0.0080 (0.0134)	0.0247 (0.0183)	-0.0090 (0.0107)
male head	-0.0667 (0.1449)	0.0131 (0.0948)	0.0672 (0.1005)	0.0401 (0.0658)
age head	0.0023 (0.0031)	0.0049** (0.0020)	0.0002 (0.0029)	0.0032* (0.0017)
highest educ	-0.0014 (0.0098)	0.0107* (0.0061)	-0.0048 (0.0099)	0.0090 (0.0056)
upper caste	-0.0139 (0.1000)	0.0772 (0.0625)	-0.0353 (0.0946)	-0.0088 (0.0519)
Hindu	0.2508* (0.1477)	-0.0392 (0.0872)	0.0686 (0.0932)	-0.0080 (0.0542)

Table 8A. Probit estimates of covariates on repayment for landed and landless(cont.)

Variables	landed		landless	
	treated	control	treated	control
urban	0.4902** (0.1942)	0.1501 (0.1165)	0.0778 (0.1055)	0.1123** (0.0564)
idiosyncratic shock	-0.1565* (0.0824)	-0.1154** (0.0523)	-0.0293 (0.0764)	-0.0407 (0.0443)
covariant shock	-0.2403** (0.1075)	0.0546 (0.0649)	0.1509 (0.1800)	-0.0470 (0.1173)
any insurance	0.0066 (0.0921)	0.0923 (0.0600)	-0.0354 (0.0803)	0.1138** (0.0467)
single loan	0.1436 (0.0938)	-0.1223** (0.0590)	0.0245 (0.0798)	0.0805* (0.0448)
loan productive	0.0712 (0.0884)	0.0979* (0.0580)	0.0819 (0.0869)	0.0817* (0.0480)
largest formal	-0.2162** (0.0941)	-0.1769*** (0.0606)	-0.1400 (0.0912)	-0.0147 (0.0529)
log loan	-0.2344*** (0.0415)	-0.2530*** (0.0287)	-0.2497*** (0.0333)	-0.2900*** (0.0200)
member credit	-0.2208** (0.1021)	-0.0762 (0.0692)	-0.0277 (0.0849)	-0.0927* (0.0552)
member social group	-0.2282 (0.1610)	0.1851* (0.0991)	0.0350 (0.0991)	0.0725 (0.0628)
public meetings	-0.8164*** (0.2929)	0.0857 (0.1654)	-0.0881 (0.2106)	-0.1225 (0.1160)
constant	5.2697*** (1.7340)	0.5823 (0.6874)	1.6761 (1.3490)	1.0934** (0.5562)
State fixed effects	yes	yes	yes	yes

Notes: This table presents the coefficients of other covariates for the treated and the control group for landed and the landless borrowers. Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively. Source: IHDS-2, 2011-12.

Table 8B. Probit estimates of covariates on repayment for small & above and otherwise

Variables	small & above		below small & above	
	treated	control	treated	control
land ownership	-0.0012 (0.0025)	-0.0008 (0.0018)	-0.1065* (0.0608)	-0.0645 (0.0432)
phy asset index	0.5931 (0.4047)	0.0908 (0.2237)	0.4396** (0.1913)	0.3192*** (0.1116)
fin asset index	-0.0265 (0.3501)	0.2286 (0.1980)	0.5309*** (0.1551)	0.0862 (0.0938)
log con exp	-0.0848 (0.1229)	0.0277 (0.0703)	-0.0368 (0.0765)	0.1011* (0.0525)
salaried and others	0.0910 (0.1667)	0.3374*** (0.1038)	-0.0616 (0.1243)	0.0578 (0.0974)
low-income workers	-0.2269 (0.1425)	0.1427* (0.0830)	-0.2182** (0.1092)	-0.1123 (0.0879)
HH size	0.0244 (0.0225)	0.0104 (0.0144)	0.0148 (0.0169)	-0.0213** (0.0104)
male head	-0.0186 (0.1828)	0.0258 (0.1130)	0.0492 (0.0967)	0.0147 (0.0621)
age head	0.0022 (0.0037)	0.0045* (0.0023)	0.0022 (0.0026)	0.0033** (0.0016)
highest educ	0.0174 (0.0120)	0.0127* (0.0066)	-0.0106 (0.0091)	0.0070 (0.0053)
upper caste	0.1284 (0.1295)	0.0863 (0.0784)	-0.0564 (0.0833)	0.0115 (0.0478)
Hindu	0.2798 (0.1941)	-0.0471 (0.1111)	0.1053 (0.0872)	-0.0230 (0.0515)

Table 8B. Probit estimates of covariates on repayment for small & above and otherwise(cont.)

Variables	small & above		below small & above	
	treated	control	treated	control
urban	0.3989*	0.0457	0.1544	0.1518***
	(0.2136)	(0.1317)	(0.1066)	(0.0571)
idiosyncratic shock	-0.1140	-0.1063*	-0.1270*	-0.0590
	(0.1043)	(0.0606)	(0.0682)	(0.0407)
covariant shock	-0.3012**	0.0078	-0.0164	0.0271
	(0.1342)	(0.0804)	(0.1249)	(0.0806)
any insurance	0.1460	0.1229*	-0.1051	0.0995**
	(0.1116)	(0.0701)	(0.0721)	(0.0432)
single loan	0.0208	-0.1206*	0.1266*	0.0438
	(0.1163)	(0.0672)	(0.0740)	(0.0419)
loan productive	0.0932	0.1117	0.0626	0.0811*
	(0.1100)	(0.0705)	(0.0743)	(0.0437)
largest formal	-0.1679	-0.2108***	-0.1815**	-0.0385
	(0.1147)	(0.0719)	(0.0799)	(0.0489)
log loan	-0.2797***	-0.2536***	-0.2206***	-0.2810***
	(0.0519)	(0.0346)	(0.0309)	(0.0195)
member credit	-0.2619**	-0.1176	-0.0664	-0.0735
	(0.1236)	(0.0805)	(0.0739)	(0.0517)
member social group	-0.1053	0.1552	-0.0631	0.0861
	(0.1719)	(0.1028)	(0.0977)	(0.0638)
public meetings	-1.0301***	0.0702	-0.1818	-0.0800
	(0.3690)	(0.2300)	(0.1904)	(0.1026)
constant	5.9041***	1.3132*	2.5154**	0.6770
	(2.0221)	(0.6755)	(1.2230)	(0.5737)
State fixed effects	yes	yes	yes	yes

Notes: This table presents the coefficients of other covariates for the treated and the control group for the small and above group and those who have land ownership below this. Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

Table 8C. Probit estimates of covariates on repayment for semi-med & above and otherwise

Variables	semi-med & above		below semi-med & above	
	treated	control	treated	control
land ownership	-0.0007 (0.0020)	-0.0012 (0.0019)	-0.0306 (0.0260)	0.0028 (0.0210)
phy asset index	0.4762 (0.4116)	0.4550* (0.2588)	0.3817** (0.1745)	0.2676** (0.1071)
fin asset index	-0.0851 (0.4103)	-0.0992 (0.2724)	0.5752*** (0.1432)	0.1096 (0.0921)
log con exp	-0.0059 (0.1478)	-0.0146 (0.0956)	-0.0682 (0.0673)	0.0933** (0.0466)
salaried and others	-0.0162 (0.1744)	0.4096*** (0.1372)	0.0522 (0.0999)	0.1559* (0.0804)
low-income workers	-0.3913* (0.2123)	0.0745 (0.1341)	-0.1134 (0.0850)	-0.0154 (0.0714)
HH size	0.0108 (0.0250)	0.0169 (0.0176)	0.0212 (0.0147)	-0.0199** (0.0097)
male head	-0.0675 (0.2050)	0.1435 (0.1471)	0.0866 (0.0888)	-0.0005 (0.0600)
age head	-0.0014 (0.0039)	0.0087*** (0.0028)	0.0025 (0.0023)	0.0023 (0.0015)
highest educ	0.0333*** (0.0127)	0.0148* (0.0081)	-0.0131* (0.0079)	0.0076 (0.0048)
upper caste	0.0190 (0.1268)	0.1436 (0.0940)	-0.0227 (0.0764)	0.0136 (0.0449)
Hindu	0.3075 (0.2492)	0.0094 (0.1701)	0.1094 (0.0795)	-0.0153 (0.0478)

Table 8C. Probit estimates of covariates on repayment for semi-med & above and otherwise(cont.)

Variables	semi-med & above		below semi-med & above	
	treated	control	treated	control
urban	0.2514 (0.2510)	0.1561 (0.1712)	0.1508 (0.0996)	0.1264** (0.0538)
idiosyncratic shock	-0.1004 (0.1040)	-0.1726** (0.0716)	-0.0942 (0.0616)	-0.0509 (0.0385)
covariant shock	-0.2543 (0.1566)	-0.0008 (0.0949)	-0.0291 (0.1016)	0.0037 (0.0699)
any insurance	0.1542 (0.1140)	0.0596 (0.0786)	-0.0304 (0.0647)	0.1205*** (0.0421)
single loan	-0.0165 (0.1218)	-0.1873** (0.0805)	0.1237* (0.0650)	0.0388 (0.0397)
loan productive	0.0564 (0.1142)	0.0038 (0.0875)	0.0717 (0.0654)	0.1021** (0.0412)
largest formal	-0.0662 (0.1230)	-0.0660 (0.0866)	-0.2090*** (0.0708)	-0.0967** (0.0458)
log loan	-0.3170*** (0.0649)	-0.2861*** (0.0467)	-0.2313*** (0.0276)	-0.2652*** (0.0189)
member credit	-0.1821 (0.1340)	-0.1159 (0.1070)	-0.0878 (0.0664)	-0.1001** (0.0486)
member social group	0.1075 (0.1406)	0.1242 (0.0912)	-0.0474 (0.0948)	0.0900 (0.0624)
public meetings	-0.7014* (0.4099)	-0.1666 (0.2662)	-0.2257 (0.1778)	-0.0656 (0.0938)
constant	4.3222* (2.2746)	1.3256 (0.8493)	2.9298*** (1.0838)	0.6853 (0.5137)
State fixed effects	yes	yes	yes	yes

Notes: This table presents the coefficients of other covariates for the treated and the control group for the semi-medium and above group and those who have land ownership below this. Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

Table 8D. Probit estimates of covariates on repayment for medium & above and otherwise

Variables	medium & above		below medium & above	
	treated	control	treated	control
land ownership	-0.0041 (0.0026)	-0.0017 (0.0018)	-0.0148 (0.0141)	0.0049 (0.0108)
phy asset index	0.7664* (0.4433)	0.2469 (0.3039)	0.2990* (0.1687)	0.3191*** (0.1034)
fin asset index	-0.0627 (0.4660)	-0.0395 (0.3497)	0.5110*** (0.1382)	0.0900 (0.0876)
log con exp	-0.0632 (0.2019)	-0.0848 (0.1419)	-0.0364 (0.0626)	0.0905** (0.0440)
salaried and others	-0.4175 (0.2751)	0.2573 (0.1882)	0.1244 (0.0878)	0.2183*** (0.0712)
low-income workers	-0.4305* (0.2379)	0.1665 (0.1470)	-0.0699 (0.0740)	0.0295 (0.0625)
HH size	0.0106 (0.0261)	-0.0158 (0.0201)	0.0148 (0.0139)	-0.0080 (0.0094)
male head	0.6166* (0.3384)	0.0257 (0.2178)	0.0060 (0.0846)	0.0127 (0.0578)
age head	-0.0002 (0.0059)	0.0081** (0.0038)	0.0014 (0.0021)	0.0031** (0.0014)
highest educ	0.0166 (0.0180)	0.0242** (0.0111)	-0.0042 (0.0071)	0.0066 (0.0044)
upper caste	-0.2275 (0.1681)	-0.0172 (0.1163)	-0.0215 (0.0708)	0.0524 (0.0428)
Hindu	0.4969 (0.3266)	0.1392 (0.2409)	0.0733 (0.0745)	-0.0123 (0.0458)

Table 8D. Probit estimates of covariates on repayment for medium & above and otherwise(cont.)

Variables	medium & above		below medium & above	
	treated	control	treated	control
urban	0.3109 (0.3123)	0.0608 (0.2273)	0.1252 (0.0930)	0.1296** (0.0517)
idiosyncratic shock	-0.1940 (0.1412)	-0.2045** (0.0980)	-0.0839 (0.0561)	-0.0608* (0.0364)
covariant shock	-0.2788* (0.1476)	-0.0100 (0.0993)	-0.0297 (0.0947)	0.0046 (0.0624)
any insurance	0.1662 (0.1506)	0.0946 (0.1019)	0.0007 (0.0595)	0.1054*** (0.0401)
single loan	0.0958 (0.1915)	-0.1463 (0.1161)	0.1095* (0.0599)	0.0201 (0.0379)
loan productive	0.0859 (0.1857)	0.0593 (0.1411)	0.0727 (0.0596)	0.0887** (0.0392)
largest formal	-0.0867 (0.1704)	-0.0788 (0.1212)	-0.1993*** (0.0649)	-0.0956** (0.0430)
log loan	-0.2365*** (0.0906)	-0.2523*** (0.0722)	-0.2602*** (0.0256)	-0.2715*** (0.0179)
member credit	-0.1726 (0.1864)	-0.1540 (0.1414)	-0.0916 (0.0611)	-0.0898* (0.0460)
member social group	0.0079 (0.1822)	0.1312 (0.1262)	-0.0224 (0.0862)	0.0828 (0.0566)
public meetings	-0.8116 (0.5680)	-0.1656 (0.4020)	-0.2698* (0.1627)	-0.0780 (0.0871)
constant	3.7632 (2.9259)	1.5884 (1.1638)	2.9968*** (1.0243)	0.6485 (0.4814)
State fixed effects	yes	yes	yes	yes

Notes: This table presents the coefficients of other covariates for the treated and the control group for the medium and above group and those who have land ownership below this. Robust standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% respectively.

Source: IHDS-2, 2011-12.

Chapter 6

Conclusion

The problems of credit markets are diverse and plenty of studies exist till date to capture and address these problems. Previous studies have modeled the complex nature of interaction between formal and informal lenders and have predicted that market segmentation of different types can persist with rationing being a likely consequence of such interactions. The empirical literature resonates well with the theoretical findings. Lack of (sufficient) collateral leads to widespread rationing, especially in the formal sector. As some studies suggest, to do away with stringent collateral requirements, lenders may also utilize social capital/connections of borrowers to lower credit rationing and defaults. But there are always hindrances to effective functioning of credit markets in the form of imperfect information, weak institutions, and a weak enforcement system. These may undermine any policies aimed at achieving inclusive credit for all and timely repayment of loans. As such, policies are designed taking these constraints into account.

Given these imperfections of an underdeveloped credit market, the present study digs deeper into different aspects of the credit market. We contribute to the existing literature in the following dimensions. First, a crucial problem in less developed and developing economies is credit rationing. In the second chapter, we build a model of strategic interaction between a formal lender and an informal lender with the assumption that lenders maximize their profits. We find that the equilibrium strategies in most of the results depend on the difference between the expected returns from risky and safe projects where the risky project has higher expected returns. There occurs segmentation of the credit market in terms of risk and wealth of borrowers. Rationing of poor safe borrowers from the credit market is inevitable when the moneylender's capacity is sufficiently small, suggesting a low income trap for them. The novelty

of our study lies in that unlike the previous literature on strategic interaction that assume zero profit (Bertrand Paradox) condition, the present study shows that zero profit is only one of the possible Nash equilibrium outcomes in the model. There is an optimal contract at which the lenders differentiate in terms of repayment and collateral and earn positive profits under certain condition. The condition is that when the difference between the expected returns from risky and safe borrowers (projects) is less than some threshold value, the lenders offer contracts at which they earn positive profits and borrowers are driven down to their reservation utility. Further, in case of capacity constraint of the moneylender, a zero-profit outcome is never a Nash equilibrium outcome as lenders offer such contracts to borrowers at which they earn positive profits. The single crossing property is satisfied in all the results.

In line with the predictions of our theoretical model, the literature suggests that land is one of the most dominant forms of collateral in developing economies. All lenders more or less accept land as collateral while granting credit. However, it is observed that the landless segment also get loans. Thus, in the third chapter we examine whether ownership of other assets (physical and financial) substitute or complement land ownership in facilitating credit access for Indian households. We examine this nexus in case of formal vis-a-vis informal credit sectors. We further examine if there is any relationship between the wealth variables (land, physical assets, financial assets) and the purpose of loan application which represents immediate and direct return from the project. We find that both physical assets and financial assets act as substitute to land in credit access. Further, a complementarity is observed between land ownership and financial instruments, and between land ownership and loan purpose, especially productive investments in case of formal credit market. We also find an interesting pattern of association between occupation status of borrowers and their credit access, this relationship being centered on land ownership. On one hand, households engaged in salaried jobs and other allied professions and on the other hand, the labourer class and those involved in low income jobs both have lower chances to get a loan, and particularly to get formal loan relative to the households engaged in cultivation and allied agriculture. We argue that these two categories of households make up about 97.07% of the landless borrowers, and their average size of land ownership is much smaller than the cultivators and the allied class, and this may lower their probability of credit access. Overall, this chapter shows that being landless need not necessarily be a constraint for these borrowers, since there is evidence of substitution between land ownership and each of financial and physical assets.

The literature suggests that non-market institutions (NMIs) are an integral part of credit market in developing economies, as are market institutions. When market fails, NMIs emerge to supplement incomplete market insurance (Arnott & Stiglitz, 1991). Social networks are a good example of NMIs. In developing economies, borrowings from friends and relatives are very popular and these represent a form of NMIs. But, there may be a cost associated with this. When borrowers rely excessively on loan from friends and relatives (FR network), it can reduce their participation in different forms of market credit, such as banks, microfinance institutions and moneylenders. The fourth chapter of the thesis looks exactly into this. We examine whether borrowings from FR network have any impact on borrowing from bank, MFIs and moneylenders taking the case of Indian households. We find that households who have borrowed from their FR network are more likely to apply to both formal (bank and MFI) and informal (moneylender) lenders relative to borrowers without an FR loan. This could suggest that when a borrower is able to meet a fraction of his credit demand from his FR network, he becomes eligible for a loan from other lenders with his available collateral or it can also increase his demand for loan due to new investment opportunities. However, we find that a loan from friends/relatives reduces the probability of approval from bank, and this is true for a few states of India. One plausible explanation could be that in case of these states, households with a loan from their FR network demand a higher amount of credit from bank, which makes it more likely that their chances of loan approval goes down vis-a-vis those without an FR loan. This chapter also finds evidence of various channels through which FR network affects credit access in case of different lenders. We observe a complementary association between FR network and volume of land ownership of borrowers in increasing borrower's probability of application to bank, moneylender and MFIs. We find that MFIs are more likely to grant credit to the poorer segment of the society, comprising of the landless and marginal land owners vis-a-vis the land rich households. Further, FR network is complementary to political network as far as loan approval from bank is concerned. This finding has important implications in India where political power determines access to various social schemes for the poor. This study also finds that FR network increases the likelihood of loan application to moneylender for households who have a higher social spending, on average. We argue that as moneylender credit is usually more expensive, such households may use their costly network to borrow from moneylender. This finding points to the insufficient penetration of banks and of microfinance institutions.

Other than rationing, credit markets are plagued by another problem, which is large scale default by borrowers. This is further aggravated by weak institutions and legal framework in

the economy. The political system also plays an important role here. In presence of clientelism, borrowers may tend to default when the gains from default exceed the cost of default. The role of social connections on loan repayment has been well explored in the literature. However, these are centred around group lending programs where repayment rests on joint liability. Also, there are many firm level studies which explores this relationship. As such, the fifth chapter of the thesis attempts to establish a causal link between political connections of borrower households and their probability of loan repayment in case of India. As individual liability is different from joint liability, this is a question worth exploring whether individual households are able to take advantage of their connections in repaying their loan. The empirical exercise reveals that households that are politically connected have significantly higher probabilities to repay their loan vis-a-vis borrowers without connections. We also find that access to various government schemes partially mediates the observed relationship between connections and repayment. In particular, political connections increase access to different schemes of the government, however, surprisingly, these schemes reduce the likelihood of repayment. Hence, clientelism is evident in case of how access to government schemes affect repayment but not how political connections affect repayment, because after controlling for government schemes, political connections still have a positive effect on repayment probabilities of households. Thus, we may say that political connections discipline borrowers to repay their loan.

6.1 Policy Implications

The findings from the chapters generates several practical implications. These can throw some light on the policies that may be important to tackle the issues in an underdeveloped credit market such as in India. In the second chapter, we show that when the informal lender has limited capacity, any competition between lenders leads to rationing of the poorer borrowers who are willing to invest in safe projects and this suggests a potential poverty trap for this segment of borrowers. One policy implication that emerges is strategic interaction between moneylenders and formal lenders may not lead to a competitive outcome. The government should directly intervene and incorporate poor households in its priority sector lending schemes.

In the third chapter, we put forward the idea that even if borrowers do not own land, they can still get loan, especially from the formal sector if they own physical assets and financial assets. But, it is highly likely that there is a positive correlation among ownership of different assets, for example, a borrower who owns land is likely to invest in financial assets. This is

also somewhat linked to the initial asset endowments of households. The higher the initial endowments, higher are the opportunities for them to borrow in the credit market for investment and this can further add to their asset base. In line with chapter 2, this points to low income and asset trap for households who cannot undertake income generating activities due to no(insufficient) initial endowments and due to lack of formal credit. Given these, some policy prescriptions emerge. First, credit policies should be properly designed so that credit access becomes easy. For instance, the priority sector lending should be directed towards the poor and asset less borrowers. Second, since land continues to be a popular form of collateral for lenders, some initiatives in the direction of land redistribution and proper registration of ownership are equally important. Joint ownership of land, fragmented landholdings, land held as common properties, etc. are some key impediments in the effective functioning of land markets in India. Hence, proper measures should be adopted in this regard. Third, financial literacy can play an important role in making people from backward and disadvantaged regions aware of credit market opportunities. They should be encouraged to participate in social insurance schemes, savings and investment schemes, etc. These are likely to increase their potential for income generation.

In the fourth and the fifth chapters, we show how different types of social networks may help in credit access of households and in their loan repayment. Social networks, if utilized properly may alleviate the need for physical collateral. In chapter 4, we find that having a loan from friends and/or relatives increases a household's chances of application to other lenders like banks, micro-finance institutions and moneylenders. A borrower who was earlier not eligible for a given amount of loan with his available collateral from other lenders may be now eligible when he has obtained some loan from his FR network and which reduces his total demand for loan. Alternately, the availability of FR loan may encourage a borrower to invest in new opportunities and this may increase his credit demand from other lenders to finance the investment. In terms of approval, FR loan increases the probability of getting bank loan for some states while reduces it for others. These networks are automatically formed in course of one's lifetime through interactions with people. Policy makers should incorporate these dimensions in evaluating borrowers' application. For instance, friends and relatives can refer a potential borrower to a lender which can increase his chances of approval. Likewise, lenders, particularly banks can utilize FR network to monitor borrowers' projects, reduce moral hazard and ensure timely repayment of loans.

In the fifth chapter, we find a beneficial impact of political connections on loan repayment of borrowers. These connections can have a disciplining effect on borrowers' repayment. Though one cannot rule out the possibility of corruption in the bureaucracy and studies have shown that clientelism has adverse repercussions on the economy, we show that this is not always true, for example in terms of loan repayment. But, we also find some evidence of clientelism in terms of political connections increasing a household's access to different schemes of the government. In a democracy like India where the ruling and opposition parties are always involved in competition, it is obvious that both positive and negative sides of bureaucracy are likely to coexist and thus it may lead to some policy suggestions. First, we emphasize on the idea that individuals are concerned about their reputation in the society and when they are active members in some political parties or panchayats, the fear of losing reputation due to default may act as a deterrent to strategic default. This is a stand-alone cost of default and is independent of how other members in the network behave, according to Muduli and Dash (2019). But, there is also an imitation cost of default such that when the majority in one's network default, the individual will be more likely to default (Muduli & Dash, 2019). Thus, we have a clear message that good repayment performance rests strictly on the condition that the party is well-functioning and punish the members for any unwanted activities, e.g., strategic default. Second, we show in our study that the effect of political connections is heterogeneous across land ownership. In particular, it is the landless segment and those in the lower end of land distribution are more likely to benefit from these connections in repaying their loan. Thus, clientelism need not always favour the poor as is argued by some studies (Bardhan & Mookherjee, 2016; Bhattacharya et al., 2017). It has an important message. Lenders tend to associate size of land ownership (collateral) with positive repayment potential of borrowers. However, as we show, the repayment performance is better for the relatively land poor segment and this is true when they are politically connected. Thus, lenders may utilize this information about political connections together with availability of physical collateral in evaluating credit worthiness of borrowers.

6.2 Scope for improvement and future work

In this study, we present a broad picture highlighting different dimensions of the credit market. However, there remains some possible scope for extending and improving our work in the future which we present below.

Some of the possible scope for improvement in chapter 2 are as follows. First, we consider a discrete risk profile of borrowers, comprising of only the safe and the risky types while in reality there can be a continuum of risk profile, for example, slightly risky to highly risky. Second, the model assumes that both safe and risky borrowers demand the same loan amount of L . Similarly, lenders offer the same loan size L to all borrowers, irrespective of their risk and wealth profiles. It would be our aim in the future to vary the size of the loan and examine if the optimal strategies of the lenders change. Third, we model a simple game involving only two players, interacting only once. Allowing for two or more period game may lead to the possibility of collusion and hence different equilibrium outcomes for each lender. Fourth, we assume only one type of capacity constraint of the moneylender such that it can lend using its available funds. However, in reality it is possible that it can relax its capacity constraint by borrowing from the bank. When the capacity is not binding, the nature of competition between the lenders may change. Likewise, the banking sector need not have unlimited funds and allocate the available funds based on some criterion which can aggravate the problem of rationing.

The next three chapters deal with data. An important limitation in case of all the empirical studies is that we have exploited cross sectional data to address the questions in each study. Due to unavailability of some key variables in the first round of India Human Development Survey (IHDS, 2005), we utilize only the second wave of this survey (2011-12). A panel structure would be able to explain a dynamic pattern of relationship between the independent and the dependent variables.

In the third chapter, we examine the nature of substitutability and/or complementarity between land and other assets. But, some possible extensions in the empirical framework need mention. First, we could not capture the quality of land due to data limitations. All we consider is the total volume of land owned by households. Land differs in quality and hence, capturing this is important. Second, the data provides information on different asset variables like land, physical assets and financial instruments. However, there is no information on the status of the actual collateral pledged, that is, whether a loan taken by a household was backed by any form of security. Hence, the results drawn from this study should be interpreted as being suggestive and with caution.

In the fourth and the fifth chapters, we use social networks as variables in the empirical framework. A major problem here is that social network is a vague concept. We could not capture it deeply in the study except using only the information provided in the data for different social network variables.

We highlight some possible scope for improvement in chapter 4. First, when we estimate the nature of relationship between loans from FR network and loans from other lenders, we assume the direction of the relation to be from FR loan to market loans. But, given the data, we are unable to identify the sequence of the events, since we rely on a cross sectional data. This is a complex relationship and capturing this appropriately is important to establish any causal effect. However, we attempt to minimize any bias arising from the estimation by using instrumental variables for FR loan(network). Second, we examine the relationship between FR network and political network in influencing credit application and approval of borrowers across different credit sectors. The data provides no information to distinguish between these two network types. If that were possible, we could say how much of the interaction effect is attributable to political connections alone and so on.

In the fifth chapter, we estimate the causal effect of political connections on loan repayment of borrower households. Some possible extensions of this study may be noted. First, we consider a simple definition of political network and we could not distinguish between the type of this network, for example, ruling or opposition. This is due to non-availability of information. This characterization of political network would provide a richer set of results and probably different from what we have found. It is possible that the repayment outcomes differ under the regime of the party in power vis-a-vis the opposition. For instance, the ruling party may have a tendency to waive loans of poor borrowers to increase their support for the next phase of elections. In that case, we should observe a lower repayment probability of a borrower who is a member of the ruling party than if he is from the opposition party. The second important limitation of this study is that we consider the overall repayment probability of each household, rather than for a specific sector, formal or informal. We do not examine the causal effect for each sector separately due to smaller variability in the dependent variable (very fewer number of borrowers have repaid their largest formal or informal loan). Though this would capture a more reliable result, we refrain from doing so due to limited variation in the sample of borrowers.

6.3 Conferences and Workshops

- PhD Colloquium organized by IGIDR, Mumbai from 5th-8th November 2019.
- 61st ISLE Conference organized by Patiala University, Punjab from 7th-9th December 2019.
- Asian Meeting of the Econometric Society (AMES) hosted by Curtin University, Malaysia during 25th-27th June 2021.
- 7th IGC-ISI Delhi Summer School in Development Economics from 11th-14th July 2021.
- International conference & 52nd Annual Meet of Regional Science Association, India from Dec 8th-10th 2021.
- Delhi Winter School organized by the Centre for Development Economics (CDE) jointly with the Econometric Society at the Delhi School of Economics from Dec 15th-18th 2021.
- 6th annual meeting of the Society of the Economics of the Household (SEHO) hosted by UCL, London during 23rd-24th May 2022.
- 100 Years of Economic Development hosted by Cornell University in Ithaca, NY from 15th-17th September 2022.
- PhD Colloquium organized by IGIDR, Mumbai from 1st-4th November 2022.
- Credit Markets and Policies in South Asia: Issues and Challenges organized by YSI-INET & IIT Tirupati from 7th to 9th December 2022.
- Research Methodology Course for PhD Students in Social Science, held at the Indian Statistical Institute, North-East Centre, Tezpur, during January 15th-25th 2018.
- Capacity building workshop on NSSO Unit level data use held in the Department of Economics of Gauhati University during 13th-19th March 2019.
- An Introduction to Exploratory Factor Analysis during 15th-16th September 2020 organized by the Department of Economics, Presidency University, Kolkata.
- Impact Evaluation: Theory & Practice held between 28th September-1st October 2020 organized by the Department of Economics, Presidency University, Kolkata.

6.4 Publications

- The role of financial and physical assets as substitute or complementary to land as collateral in credit market: Evidence from Indian households.
(Pallabi Chakraborty, Amarjyoti Mahanta). Forthcoming in *Economic Systems*.
- Asymmetric information, capacity constraint and segmentation in credit markets.
(Pallabi Chakraborty, Amarjyoti Mahanta). Forthcoming in *Indian Growth and Development Review*.



References

- Acemoglu, D. (2006). A simple model of inefficient institutions. *The Scandinavian Journal of Economics*, 108(4), 515–546.
- Andersen, T. B., & Malchow-Møller, N. (2006). Strategic interaction in undeveloped credit markets. *Journal of Development Economics*, 80, 275–298.
- Arnott, R., & Stiglitz, J. E. (1991). Moral hazard and nonmarket institutions: Dysfunctional crowding out or peer monitoring? *The American Economic Review*, 179–190.
- Banerjee, A., & Munshi, K. (2004). How efficiently is capital allocated? Evidence from the knitted garment industry in Tirupur. *The Review of Economic Studies*, 71(1), 19–42.
- Bardhan, P., & Mookherjee, D. (2016). Clientelistic politics and economic development: An overview. *EDI-RA1 Working Paper*.
- Bardsley, P., & Meager, R. (2019). Competing lending platforms, endogenous reputation, and fragility in microcredit markets. *European Economic Review*, 112, 107–126.
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173.
- Barslund, M., & Tarp, F. (2008). Formal and informal rural credit in four provinces of Vietnam. *The Journal of Development Studies*, 44(4), 485–503.
- Bell, C., Srinivasan, T., & Udry, C. (1997). Rationing, spillover, and interlinking in credit markets: the case of rural Punjab. *Oxford Economic Papers*, 49, 557–585.
- Berg, C. N., Emran, M. S., & Shilpi, F. (2015). Microfinance and moneylenders: long-run effects of mfis on informal credit market in Bangladesh. *Available at SSRN 2677316*.
- Besanko, D., & Thakor, A. V. (1987). Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets. *International Economic Review*, 671–689.
- Besley, T., & Coate, S. (1995). Group lending, repayment incentives and social collateral. *Journal of Development Economics*, 46(1), 1–18.
- Bhattacharya, A., Kar, A., & Nandi, A. (2017). Local institutional structure and clientelistic

access to employment: the case of MGNREGS in three states of India.

- Binswanger, H. P., & Rosenzweig, M. R. (1986a). Behavioural and material determinants of production relations in agriculture. *The Journal of Development Studies*, 22(3), 503–539.
- Binswanger, H. P., & Rosenzweig, M. R. (1986b). *Credit markets, wealth and endowments in rural South India*. Citeseer.
- Blackwell, M., Iacus, S., King, G., & Porro, G. (2009). Cem: Coarsened exact matching in Stata. *The Stata Journal*, 9(4), 524–546.
- Bose, P. (1998). Formal–informal sector interaction in rural credit markets. *Journal of Development Economics*, 56, 265–280.
- Bose, U., Arun, T., & Arun, S. (2021). Do information networks benefit households with female heads? *Economic Modelling*, 103, 105613.
- Boucher, S., & Guirking, C. (2007). Risk, wealth, and sectoral choice in rural credit markets. *American Journal of Agricultural Economics*, 89, 991–1004.
- Boucher, S. R., Carter, M. R., & Guirking, C. (2008). Risk rationing and wealth effects in credit markets: Theory and implications for agricultural development. *American Journal of Agricultural Economics*, 90(2), 409–423.
- Bovenberg, D., Rottner, R., & Eberhart, R. N. (2019). Causal claims from observational data: An endogenous treatment effects approach on a matched sample. In *Academy of management proceedings* (Vol. 2019, p. 19472).
- Carter, M. R., & Olinto, P. (2003). Getting institutions “right” for whom? credit constraints and the impact of property rights on the quantity and composition of investment. *American Journal of Agricultural Economics*, 85(1), 173–186.
- Chakravorty, S. (2013). A new price regime: Land markets in urban and rural India. *Economic and Political Weekly*, 45–54.
- Chatterjee, S., & Pal, D. (2021). Is there political elite capture in access to energy sources? evidence from Indian households. *World Development*, 140, 105288.
- Chaudhuri, K., & Cheral, M. M. (2012). Credit rationing in rural credit markets of India. *Applied Economics*, 44(7), 803–812.
- Chen, H.-K., Liao, Y.-C., Lin, C.-Y., & Yen, J.-F. (2018). The effect of the political connections of government bank CEOs on bank performance during the financial crisis. *Journal of Financial Stability*, 36, 130–143.
- Cheng, E. (2007). The demand for microcredit as a determinant for microfinance outreach-evidence from China. *Savings and Development*, 307–334.
- Cole, S. (2009). Fixing market failures or fixing elections? agricultural credit in India. *American*

Economic Journal: Applied Economics, 1(1), 219–50.

- Conning, J., & Udry, C. (2007). Rural financial markets in developing countries. *Handbook of Agricultural Economics*, 3, 2857–2908.
- Deininger, K., Jin, S., & Nagarajan, H. K. (2009). Determinants and consequences of land sales market participation: Panel evidence from India. *World Development*, 37(2), 410–421.
- Demont, T. (2016). Microfinance spillovers: A model of competition in informal credit markets with an application to Indian villages. *European Economic Review*, 89, 21–41.
- Desai, S., Vanneman, R., et al. (2015). *India human development survey-ii (ihds-ii), 2011-12* (Vol. 31). Inter-university Consortium for Political and Social Research Ann Arbor, MI.
- Deshpande, A., & Khanna, S. (2021). Can weak ties create social capital? evidence from self-help groups in rural India. *World Development*, 146, 105534.
- Ding, Z., & Abdulai, A. (2020). An analysis of the factors influencing choice of microcredit sources and impact of participation on household income. *Journal of International Development*, 32(4), 505–525.
- Domeher, D., & Abdulai, R. (2012). Access to Credit in the Developing World: does land registration matter? *Third World Quarterly*, 33(1), 161–175.
- Dower, P. C., & Potamites, E. (2014). Signalling creditworthiness: Land titles, banking practices, and formal credit in Indonesia. *Bulletin of Indonesian Economic Studies*, 50(3), 435–459.
- Dufhues, T., Buchenrieder, G., Quoc, H. D., & Munkung, N. (2011). Social capital and loan repayment performance in Southeast Asia. *The Journal of Socio-Economics*, 40(5), 679–691.
- DuGoff, E. H., Schuler, M., & Stuart, E. A. (2014). Generalizing observational study results: applying propensity score methods to complex surveys. *Health Services Research*, 49(1), 284–303.
- Dyzenhaus, A. (2021). Patronage or policy? The politics of property rights formalization in Kenya. *World Development*, 146, 105580.
- Fafchamps, M., & Gubert, F. (2007). Risk sharing and network formation. *American Economic Review*, 97(2), 75–79.
- Feder, G., & Feeny, D. (1991). Land tenure and property rights: Theory and implications for development policy. *The World Bank Economic Review*, 5(1), 135–153.
- Feder, G., Onchan, T., & Raparla, T. (1988). Collateral, guaranties and rural credit in developing countries: evidence from Asia. *Agricultural Economics*, 2(3), 231–245.
- Ferrara, E. L. (2003). Kin groups and reciprocity: A model of credit transactions in Ghana.

American Economic Review, 93(5), 1730–1751.

Fisman, R., Paravisini, D., & Vig, V. (2017). Cultural proximity and loan outcomes. *American Economic Review*, 107(2), 457–92.

Fowler, P. (2012). *Covariate selection and coarsened exact matching in causal inference: A simulation study*.

Fu, J., Shimamoto, D., & Todo, Y. (2017). Can firms with political connections borrow more than those without? Evidence from firm-level data for Indonesia. *Journal of Asian Economics*, 52, 45–55.

Gaye, M. (2022). Job satisfaction: towards internalizing the feeling of inequality between men and women. *Applied Economics*, 54(33), 3823–3839.

Georgarakos, D., & Fürth, S. (2015). Household repayment behavior: The role of social capital and institutional, political, and religious beliefs. *European Journal of Political Economy*, 37, 249–265.

Ghatak, M. (1999). Group lending, local information and peer selection. *Journal of Development Economics*, 60(1), 27–50.

Ghatak, M. (2000). Screening by the company you keep: Joint liability lending and the peer selection effect. *The Economic Journal*, 110(465), 601–631.

Ghatak, M., & Guinnane, T. W. (1999). The economics of lending with joint liability: theory and practice. *Journal of Development Economics*, 60(1), 195–228.

Ghosh, P., Mookherjee, D., Ray, D., et al. (2000). Credit rationing in developing countries: an overview of the theory. *Readings in the Theory of Economic Development*, 7, 383–401.

Ghosh, P., & Ray, D. (2016). Information and enforcement in informal credit markets. *Economica*, 83(329), 59–90.

Ghosh, S. (2020). Bank lending and monetary transmission: Does politics matter? *Journal of Quantitative Economics*, 18(2), 359–381.

Giné, X. (2011). Access to capital in rural Thailand: An estimated model of formal vs. informal credit. *Journal of Development Economics*, 96, 16–29.

Guérin, I., Roesch, M., Venkatasubramanian, G., & D’espallier, B. (2012). Credit from whom and for what? the diversity of borrowing sources and uses in rural Southern India. *Journal of International Development*, 24, S122–S137.

Guha, B., & Chowdhury, P. R. (2013). Micro-finance competition: Motivated micro-lenders, double-dipping and default. *Journal of Development Economics*, 105, 86–102.

Guirking, C. (2008). Understanding the coexistence of formal and informal credit markets in Piura, Peru. *World Development*, 36, 1436–1452.

- Heckman, J. J. (1977). *Sample selection bias as a specification error (with an application to the estimation of labor supply functions)* (Tech. Rep.). National Bureau of Economic Research.
- Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica: Journal of the Econometric Society*, 153–161.
- Herath, G. (1996). Rural Credit Markets and Imperfect Information: A New Perspective. *Savings and Development*, 241–253.
- Hermes, N., Lensink, R., & Mehrteab, H. T. (2005). Peer monitoring, social ties and moral hazard in group lending programs: Evidence from Eritrea. *World Development*, 33(1), 149–169.
- Heyer, J. (1989). Landless agricultural labourers' asset strategies. *IDS Bulletin*, 20(2), 33–40.
- Hoff, K., & Stiglitz, J. E. (1990). Introduction: Imperfect information and rural credit markets: Puzzles and policy perspectives. *The World Bank Economic Review*, 4(3), 235–250.
- Hoff, K., & Stiglitz, J. E. (1998). Moneylenders and bankers: price-increasing subsidies in a monopolistically competitive market. *Journal of Development Economics*, 55, 485–518.
- Hulme, D., Montgomery, R., & Bhattacharya, D. (1996). Mutual finance and the poor. a study of the federation of thrift and credit co-operatives (SANASA) in Sri Lanka.
- Hussain, M. A., & Tyagi, M. (2020). Role of political connections in land investment: Evidence from rural India. *Constitutional Political Economy*, 31(3), 344–362.
- Iacus, S. M., King, G., & Porro, G. (2012). Causal inference without balance checking: Coarsened exact matching. *Political Analysis*, 20(1), 1–24.
- Infante, L., & Piazza, M. (2014). Political connections and preferential lending at local level: Some evidence from the Italian credit market. *Journal of Corporate Finance*, 29, 246–262.
- Islam, A., Nguyen, C., & Smyth, R. (2015). Does microfinance change informal lending in village economies? evidence from Bangladesh. *Journal of Banking & Finance*, 50, 141–156.
- Jain, S. (1999). Symbiosis vs. crowding-out: the interaction of formal and informal credit markets in developing countries. *Journal of Development Economics*, 59, 419–444.
- Jia, X., Heidhues, F., & Zeller, M. (2010). Credit rationing of rural households in China. *Agricultural Finance Review*, 70(1), 37–54.
- Jiang, M., Sun, R., & Zhang, B. (2022). Social networks and household financial decisions: evidence from China. *Journal of Applied Economics*, 25(1), 58–92.
- Karaivanov, A., & Kessler, A. (2018). (dis) advantages of informal loans—theory and evidence.

European Economic Review, 102, 100–128.

- Khwaja, A. I., & Mian, A. (2005). Do lenders favor politically connected firms? Rent provision in an emerging financial market. *The Quarterly Journal of Economics*, 120(4), 1371–1411.
- Kinnan, C., & Townsend, R. (2012). Kinship and financial networks, formal financial access, and risk reduction. *American Economic Review*, 102(3), 289–93.
- Kochar, A. (1997). An empirical investigation of rationing constraints in rural credit markets in India. *Journal of Development Economics*, 53, 339–371.
- Krishnan, K. P., & Panchapagesan, V. (n.d.). Distortions in land markets and their implications for credit generation in India.
- Kumar, A., Mishra, A. K., Saroj, S., & Joshi, P. K. (2017). Institutional versus non-institutional credit to agricultural households in India: Evidence on impact from a national farmers' survey. *Economic Systems*, 41(3), 420–432.
- Kumar, N. (2020). Political interference and crowding out in bank lending. *Journal of Financial Intermediation*, 43, 100815.
- Kumar, S. M., & Venkatachalam, R. (2019). Caste and credit: A woeful tale? *The Journal of Development Studies*, 55, 1816–1833.
- Lee, S., & Persson, P. (2016). Financing from family and friends. *The Review of Financial Studies*, 29(9), 2341–2386.
- MacKinnon, D. P. (2011). Integrating mediators and moderators in research design. *Research on Social Work Practice*, 21(6), 675–681.
- Madestam, A. (2014). Informal finance: A theory of moneylenders. *Journal of Development Economics*, 107, 157–174.
- Maitra, P., Mitra, S., Mookherjee, D., & Visaria, S. (2021). Decentralized targeting of agricultural credit programs: Private versus political intermediaries.
- Mansuri, G., & Rao, V. (2013). Can participation be induced? Some evidence from developing countries. *Critical Review of International Social and Political Philosophy*, 16(2), 284–304.
- Marchenko, Y. V., & Genton, M. G. (2012). A Heckman Selection-t Model. *Journal of the American Statistical Association*, 107(497), 304–317.
- Markussen, T., & Tarp, F. (2014). Political connections and land-related investment in rural Vietnam. *Journal of Development Economics*, 110, 291–302.
- Meager, R. (2019). Understanding the Average Impact of Microcredit Expansions: A Bayesian Hierarchical Analysis of Seven Randomized Experiments. *American Economic Journal:*

Applied Economics, 11(1), 57–91.

- Meager, R. (2022). Aggregating Distributional Treatment Effects: A Bayesian Hierarchical Analysis of the Microcredit Literature. *American Economic Review*, 112(6), 1818–47.
- Mehmetoglu, M. (2018). Medsem: A Stata package for statistical mediation analysis. *International Journal of Computational Economics and Econometrics*, 8(1), 63–78.
- Meyer, R. L., & Nagarajan, G. (2006). Microfinance in developing countries: accomplishments, debates, and future directions. *Agricultural Finance Review*, 66(2), 167.
- Mishra, K., & Sam, A. G. (2016). Does women's land ownership promote their empowerment? empirical evidence from Nepal. *World Development*, 78, 360–371.
- Mohieldin, M. S., & Wright, P. W. (2000). Formal and informal credit markets in Egypt. *Economic Development and Cultural Change*, 48(3), 657–670.
- Mookherjee, D., & Motta, A. (2016). A theory of interactions between MFIs and informal lenders. *Journal of Development Economics*, 121, 191–200.
- Mowl, A. J. (2016). The technology of lending: Informal credit contracts. *unpublished*. <http://foundation.ifmr.co.in/the-technology-of-lending-informal-credit-contracts>.
- Muduli, S., & Dash, S. K. (2019). The invisible collateral. *Economic and Political Weekly*, 54(48), 13–16.
- Munshi, K. (2011). Strength in numbers: Networks as a solution to occupational traps. *The Review of Economic Studies*, 78(3), 1069–1101.
- Narayanan, S., & Chakraborty, J. (2019). Land as collateral in India. *Economic & Political Weekly*, 54(44), 45.
- Nikaido, Y., Pais, J., & Sarma, M. (2015). What hinders and what enhances small enterprises' access to formal credit in India? *Review of Development Finance*, 5(1), 43–52.
- Okten, C., & Osili, U. O. (2004). Social networks and credit access in Indonesia. *World Development*, 32(7), 1225–1246.
- Pal, D., & Laha, A. K. (2015). Sectoral credit choice in rural India. *Journal of Choice Modelling*, 14, 1–16.
- Pal, S. (2002). Household sectoral choice and effective demand for rural credit in India. *Applied Economics*, 34, 1743–1755.
- Parmeter, C. F., Sarangi, S., et al. (2020). On the complex relationship between different aspects of social capital and group loan repayment. *Economic Modelling*, 90, 92–107.
- Pender, J. L., & Kerr, J. M. (1999). The effects of land sales restrictions: Evidence from South India. *Agricultural Economics*, 21(3), 279–294.
- Pham, T. T. T., & Lensink, R. (2007). Lending policies of informal, formal and semiformal

- lenders: Evidence from Vietnam. *Economics of Transition*, 15, 181–209.
- Ramachandran, V., & Swaminathan, M. (2002). Rural banking and landless labour households: institutional reform and rural credit markets in India. *Journal of Agrarian Change*, 2(4), 502–544.
- Ray, D. (1998). *Development Economics*. Princeton University Press.
- Sagrario Floro, M., & Ray, D. (1997). Vertical links between formal and informal financial institutions. *Review of Development Economics*, 1, 34–56.
- Sanjak, J. (2012). Land titling and credit access—understanding the reality. *electronic*, <https://www.land-links.org/wp-content/uploads/2016/09/Land-Titling-and-Credit-Access-Understanding-the-Reality.pdf> (10.04. 2019).
- Sapienza, P. (2006). The effects of government ownership on bank lending. *Journal of Financial Economics*. World Bank Publications, 259–286.
- Sarap, K. (1991). Collateral and other Forms of Guarantee in Rural Credit Markets: Evidence from Eastern India. *Indian Economic Review*, 167–188.
- Sharma, M., & Zeller, M. (1997). Repayment performance in group-based credit programs in Bangladesh: An empirical analysis. *World Development*, 25(10), 1731–1742.
- Shoji, M., Aoyagi, K., Kasahara, R., Sawada, Y., & Ueyama, M. (2012). Social capital formation and credit access: Evidence from Sri Lanka. *World Development*, 40(12), 2522–2536.
- Steiner, S., Giesbert, L., & Bendig, M. (2009). Savings, Credit and Insurance: Household Demand for Formal Financial Services in Rural Ghana.
- Sun, H., Hartarska, V., Zhang, L., & Nadolnyak, D. (2018). The influence of social capital on farm household's borrowing behavior in rural China. *Sustainability*, 10(12), 4361.
- Tsai, K. S. (2004). Imperfect Substitutes: The Local Political Economy of Informal Finance and Microfinance in Rural China and India. *World Development*, 32(9), 1487–1507.
- Tsukada, K., Higashikata, T., & Takahashi, K. (2010). Microfinance Penetration and its Influence on Credit Choice in Indonesia: Evidence from a Household Panel Survey. *The Developing Economies*, 48(1), 102–127.
- Turvey, C. G., & Kong, R. (2010). Informal lending amongst friends and relatives: can microcredit compete in rural China? *China Economic Review*, 21(4), 544–556.
- Van Bastelaer, T. (1999). Imperfect information, social capital and the poor's access to credit. *Social Capital and the Poor's Access to Credit (October 1999)*. IRIS Center Working Paper(234).
- Van Bastelaer, T., & Leathers, H. (2006). Trust in lending: Social capital and joint liability seed loans in Southern Zambia. *World Development*, 34(10), 1788–1807.

- Van de Ven, W. P., & Van Praag, B. M. (1981). The demand for deductibles in private health insurance: A probit model with sample selection. *Journal of Econometrics*, 17(2), 229–252.
- Venittelli, T. (2021). Is group lending a collateral for informal credit? *Progress in Development Studies*, 14649934211063371.
- Wang, F. (2022). An empirical equilibrium model of formal and informal credit markets in developing countries. *Review of Economic Dynamics*, 46, 224–243.
- Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT press.
- Yadav, S., Otsuka, K., & David, C. C. (1992). Segmentation in rural financial markets: The case of Nepal. *World Development*, 20(3), 423–436.
- Yuan, Y., & Xu, L. (2015). Are poor able to access the informal credit market? evidence from rural households in China. *China Economic Review*, 33, 232–246.
- Zanin, L. (2017). Determinants of the conditional probability that a household has informal loans given liquidity constraints regarding access to credit banking channels. *Journal of Behavioral and Experimental Finance*, 13, 16–24.
- Zeller, M. (2006). A comparative review of major types of rural microfinance institutions in developing countries. *Agricultural Finance Review*.
- Zhang, T., Liu, H., & Liang, P. (2020). Social trust formation and credit accessibility—evidence from rural households in China. *Sustainability*, 12(2), 667.
- Zhang, Y., Lin, N., & Li, T. (2012). Markets or networks: Households' choice of financial intermediary in Western China. *Social Networks*, 34(4), 670–681.