Essays on the Impact of Microfinance on Rural Households in a Developing Country

Nudrat Faria Shreya

Submitted to the School of Economics
for the degree of
Doctor of Philosophy

June 2020

Acknowledgements

I am deeply indebted to my supervisors Zaki Wahhaj and Fernanda Leite Lopez de Leon for their constant guidance, support and endurance. One of the first things that Dr Wahhaj had said to me was that he did not want me to remember my PhD journey as a stressful period of time. Now when I have come to an end of this journey, I can surely say his supervision and recurrent reassurance had been the most important, if not the only, reason why I had not given up at various stages of my research. My second supervisor, Dr Leon, had been a constant boost to my journey as she pushed me harder each day to achieve my goal.

I would like to thank Guy Tchuente, Amrit Amirapu, Bansi Malde, Nizar Allouch, Iain Fraser and Anthony Savagar for their valuable suggestions and motivating comments at different stages of my research. I would also like to thank Maria Garcia-Alonso for her continuous support. She had patiently endured my prolonged rants and returned nothing but warmth and care.

My thanks go to my friends, classmates and colleagues for their contribution to my journey of learning. In addition, for the endless conversations and unlimited cups of tea I would like to thank Anup Mulay, Qusi Talafheh, Thomas Middleton, Arwa Abuhaimed, Isaure Delaporte and Oluwaseun Olugun. I also acknowledge the uncountable dinners shared with Anup whenever we missed home. They were always therapeutic for the dull days of research.

My sincere thanks also go to my parents, my husband and my brother. They had always managed to morally support me despite the distance and time difference. In addition, my parents have contributed to my research by helping me collect a part of the data from Bangladesh; my husband has monitored my RAs in Bangladesh and at times has also worked as one. I can never make up for all the sacrifices that they have made over the past four years.

I would like to mention my grandfather, AKM Zakariah, who had inspired my research through his own. He had left us in my first year of the program. However, his teachings, values and last words to me had kept me motivated throughout.

I want to thank Parveen Mahmud, former managing director of Grameen Telecom Trust, for her support in collecting the data I needed from various microfinance institutions in Bangladesh.

For the financial support, I gratefully acknowledge the funding of the research program of School of Economics at University of Kent.

I dedicate my thesis to my family and Dr Wahhaj. It represents their effort as much as it represents mine.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

Poverty is one of the pressing problems in the world. Poverty eradication is yet to be achieved and is currently listed in the Sustainable Development Goals (SDGs) by the United Nations. The UN listed access to credit to the poor as the primary tool to eradicate extreme poverty (UN Millennium Project Report, 2005). Approximately three billion people living in developing countries lack access to formal financial services. Microfinance has provided access to credit to the poor who were otherwise deprived of formal financial services in the developing countries. It is considered to be the stepping-stone of bringing the poor out of poverty by giving them access to collateral-free small loans. The foundation of the model was the assumption that access to credit will unleash the potential of the poor to foster growth and development. It came as a promise to promote income generating activities and boost entrepreneurship to eradicate poverty (Morduch, 1999). The promise highlighted the multiplier effects of access to credit, especially of women, in terms of women's empowerment, income generation, accomplishment of better education of children, better health expediture leading to comprehensive socio-economic welfare.

The UN declared the year of 2005 as the 'International Year of Microcredit' acknowledging its role in facilitating financial inclusion. According to Microfinance Barometer (2018), by the end of 2017, the microfinance institutions (MFIs) reached approximately 139 million clients globally with loans of a total of approximately USD 114 billion. There are over 10,000 MFIs around the world (Forbes, 2007). South Asia has largest MFI sector in the world with 85.6 million borrowers collectively. The top three MFI markets with almost two-thirds of the global borrowers include India, Bangladesh and Vietnam (Microfinance Barometer, 2018).

Microfinance started in Bangladesh when the country was struggling with many socio-economic problems such as extreme poverty, poor education, rampant child marriage and low female labour participation (Yunus, 1999; Khandker, Khalily and Khan, 1995). The MFIs lent exclusively to women to raise their bargaining power within the household to promote women's empowerment (Chaudhary, 1979; Khandker, 1985). Furthermore, to address the other socio-economic problems, the MFIs introduced a set of pledges that borrowers were required to make when joining the organisation. The pledges, referred to as '16 Decisions' of Grameen Bank (listed in the Appendix 2.9.1 of chapter 2 in page 73), were vows to be entrepreneurs, to practice subsistence farming, to build better homes, to build bettter health and sanitation facilities, to educate children, not practice child marriage and dowry, etc. These were designed to raise social awareness among microfinance clients to bring in economic prosperity in the short run with the vows such as the clients will practice subsistence farming and sell the excess produce, if any; will undertake investments for higher incomes; will work towards constructing homes. In addition to these short run goals for the clients themselves, the pledges also addressed goals for the children of the borrowers to subsequently translate into improved social development outcomes for their next generation. The pledges 7 and 11 encourage clients to educate their children and to empower the children to earn their living, and refrain from practising child marriage and dowry.

Microfinance has been in Bangladesh for more than four decades where the children of the first generation borrowers are now adults for their adult social outcomes to be measured. In addition, the country has experienced a phenomenal growth of more than 15% per year reaching around 40 million borrowers, which is almost half the share of South Asian borrowers (CGAP, 2002; Institute of Microfinance Annual Report, 2009). Reflecting on the background of microfinance sector of Bangladesh, in this dissertation we study the microfinance clients to estimate the impact of access to microfinance. Each chapter of the dissertation addresses different research questions addressing impact of access to credit on borrower welfare and welfare of the next generation encompassing both short-term and long-term impact of the programme.

The three chapters in this dissertation use the same household survey and the branch location data of the largest MFIs in Bangladesh as core datasets. The household survey, the 2014 Women's Life Choices and Attitudes Survey (the 2014

WilCAS) is a nationally representative survey of women born between 1975-1994. The 2014 WilCAS is a survey of women between the ages of 20 and 39 conducted by Asadullah and Wahhaj (2018) for a project funded by Australian AID. In addition, it includes a module on siblings of the women which allows us to compare across gender within the household. It has detailed information on location of birth of respondents, history of social outcomes of the respondents, information on all the siblings of the respondents and record of mothers' membership and interaction with MFIs of respondents. This survey is particularly suitable for this dissertation as it includes geo-referenced location of the respondents at various phases in life and microcredit history of themselves and their mothers.

Given the rich detailed information on the respondents, their siblings and their mothers, in chapter 2 and 4 we estimate the impact of credit of the mothers of the respondents and their siblings, where the mothers are microfinance clients, on the social outcomes of the respondents and their siblings (considered as children). As the microfinance programme in Bangladesh only included women, in these two chapters we refer to the borrowers as mothers and the next generation as children. In chapter 2, we estimate the impact of access to credit of mothers on the adult social outcomes of children such as completed schooling, marriage and dowry and labour market outcomes. In chapter 4, we estimate the impact of access to credit of mothers on child mortality, gender equality in mortality and early-life outcomes of children. On the other hand, in chapter 3 we estimate the impact of access to credit of respondents of the survey on the outstanding debt and psychosocial wellbeing of the respondents where the respondents are microfinance clients themselves.

In order to construct the measure of access to credit, we combine the household survey with the branch location data of the largest MFIs in Bangladesh. We collected the branch location data of all the microfinance operating branches of Grameen Bank and BRAC and their respective branch establishment dates. Grameen Bank and BRAC came into operation in Bangladesh around mid-1970s and were the only MFIs in existence till ASA, the third largest MFI, started its operation in early 1990s. We use Grameen Bank and BRAC only in chapters 2 and 4. This is because ASA expanded their branches in the mid 2000s by when the children considered in chapter 2 and 4 have crossed their school-going age. However, we add the third largest MFI, ASA, in chapter 3 where the respondents are microfinance clients themselves. ASA had already established substantially by the time the respondents became clients themselves.

We use the same research methodology, regression discontinuity design (RDD), in chapter 2 and chapter 3 to estimate the impact of access to microfinance. Regression discontinuity design has been used by a few studies to examine the impact of microfinance in Bangladesh (Pitt and Khandker, 1998; Morduch, 1998; Akhtaruzzaman and Farooq, 2016). The existing studies used the eligibility rule based on borrower's landholdings as the forcing variable but that approach has its own limitations. We contribute to the literature by using a spatial RDD which allows us to determine control and treatment groups according to geographical location as a threshold. Most MFIs, such as BRAC and ASA (the MFIs examined in the chapters in this thesis), replicated the credit model of Grameen Bank along with the promotion of the pledges.

The MFIs in Bangladesh follow an exogenous rule of operation of covering a certain distance to seek and serve borrowers. BRAC and Grameen Bank cover a geographic distance of a radius of 4-kilometers as their servicing area. This exogenous rule creates a discontinuity in access to credit for households around the servicing areas of the MFIs.[1] We take advantage of this quasi-experimental setup of access to credit and use a regression discontinuity design (RDD) as our identification strategy. The control group is taken to be the households who are not located within the operating radius of 4 kilometers of distance. The treatment group, with access to credit, is taken to be the households who are located within the operating radius of at least one MFI branch. We construct the running variable by calculating the minimum distance of each household to each of the branches of the MFIs. However, as mentioned above, the sample of interest is different in the two chapters. In chapter 2, the running variable is calculated as access to microfinance of mothers of the respondents. On the other hand, in chapter 3 the running variable is calculated as access to microfinance of the respondents themselves. This will be explained in details later in this section and in the respective chapters.

In chapter 4 of this dissertation, we estimate impact of flooding which is another important socio-economic problem of bangladesh. We estimate the impact of floods on early-life outcomes of children such as child mortality and role of credit access in coping with the shock. As mentioned before, we use the same household survey

[1]The same exogenous rule of operation is used in all three chapters in this dissertation.

where we consider the respondents and their siblings as children and calculate access to credit of mothers to address our research question. We also use the same MFI branch data of Grameen Bank and BRAC. However, we add historical data of Bangladesh Water Development Board (BWDB) on floods in Bangladesh. In this chapter, unlike the previous chapters, we use a simple logit model as our identification strategy.

Although microfinance has a large literature since the early 1980s in terms of both theoretical and empirical research, there was little causal evidence on the impact of access to credit until recently. A new literature developed during the past decade providing conclusive causal evidence of limited impact of access to microcredit. Researchers have carried out notable randomized controlled trials, often considered as the 'gold-standard' of causal estimation, in different parts of the developing world partnering with different MFIs. The studies provided evidence that increasing access to credit has limited impact on borrower welfare over a range of outcomes such as consumption, business creation, health and education (See Bauchet et al. (2011) and Banerjee, Karlan and Zinman (2015) for detailed reviews of this literature).

While the existing studies provide strong evidence on the impact of microfinance for the short run, there is limited evidence regarding the long-term impact of microfinance. In chapter 2, we examine if access to credit of MFI clients has led to positive impact on the socio-economic outcomes for the next generation in Bangladesh. Approximately 40 million households have borrowed from MFIs in Bangladesh (BRAC, 2019; Grameen Foundation, 2018). In addition to a large microfinance sector, children of first generation microfinance clients are now adults which makes it possible to study the long-term social impact of microfinance programmes initiated during the 1970s and the 1980s.

We use the nationally representative household survey of women in Bangladesh combined with the branch location data of the two largest MFIs in Bangladesh, Grameen Bank and BRAC, to investigate if access to credit of mothers and sensitivity training, in terms of the pledges, has led to positive impact on education, marriage and labour outcomes of children. We use variation in the timing of microfinance branch openings of the MFIs, relative to the birth year of the children, to identify if relieving financial constraints play a differential role for long-term outcomes. Three time variations as such are used in our study: access to credit when the child is aged 1, 8 and 12.

To determine mother's access to microfinance, we collected the branch location data at the union[2] level of all the microfinance operating branches across Bangladesh for BRAC and Grameen Bank. We spatially map the geo-referenced branches of the MFIs at the union level with the union of birth of children to calculate the distance of each branch of the MFIs from the respective union headquarters. Our outcomes, motivated by the nature of the pledges advocated by the MFIs in Bangladesh, include years of schooling, primary school completion, secondary school completion and age at marriage for children of the MFI clients. Given the background of high rate of child marriage in Bangladesh for adolescent girls, we study probability of marriage before 15 and 18 for daughters only. To examine whether mothers' access to credit leads to improved partner choices for their daughters, we look at groom characteristics. Lastly, we study if financial inclusion of mothers has led daughters to be involved in economic participation. Our results suggest some effect on the outcomes of children, such as lower educational attainment and a decline in age at marriage for both sons and daughters. However, we do not see any effect on labour outcomes for daughters in their adulthood when mothers have access to credit. In line with the existing evidence for the short run (Banerjee, Karlan and Zinman, 2015), we do not see any transformative impact of access to credit of first generation microfinance clients on the social outcomes of the next generation.

Nonetheless, over the past four decades, the microfinance sector has experienced substantial growth due to high demand for microfinance products particularly in the developing countries. The sharp growth of the microfinance industry globally, over 10% per year (Microfinance Barometer, 2018), has led to a sharp increase in competition globally among the microfinance institutions (MFIs). Furthermore, given the collapse of a few microfinance sectors due to inability of borrowers to repay their loans (as mentioned earlier), there is growing discussion about the risk of borrowers having multiple loans simultaneously leading to loan delinquency. This has particularly raised a concern among researchers given the exponential expansion of availability of credit (CGAP, 2011; Schicks, 2013). In Bangladesh, the sector has experienced a phenomenal growth rate, of 15% per year, since the 1990s when the UN announced microfinance as the tool to combat poverty (CGAP, 2002). By the end of 2014, there were over a thousand MFIs with a network of 17 thousand branches

[2]Union is the smallest rural administrative and local government unit in Bangladesh.

across the country making the Bangladeshi microfinance sector an almost saturated market.

The commercialization and expansion of the MFIs coupled with high competition, where most regions are served by more than one MFI, has led the MFIs to offer very similar loan contracts in some countries (McIntos and Wydick, 2005). The MFIs in Bangladesh, at the least the ones considered in this thesis, offer standard loan contracts often with the same grace period, interest rates and repayment schedule. However, the existing literature suggests that in the absence of a credit bureau competition among MFIs has led to a sharp increase in information asymmetry (Matin, 1997; Chaudhury and Matin, 2002, FinDev Gateway, 2011). Furthermore, the literature also suggests that information asymmetry leads to multiple borrowing among MFI clients where the clients have more than one loan simultaneously from multiple sources (Khalily et al., 2014; Khalily and Farid, 2011; Khandker, Samad and Khalily, 2016).

Reflecting on the existing literature and the background of the microfinance sector in Bangladesh, in chapter 3, we investigate whether access to multiple sources of credit has an impact on debt and monthly income among microfinance clients in Bangladesh. In addition, we examine if debt has an impact on psychosocial wellbeing of the borrowers. We take advantage of the same exogenous rule of MFIs, as described for chapter 2, in Bangladesh for our identification strategy for spatial RDD. To examine if an additional source of credit affects borrowing and monthly income, we compare individuals with access to two sources of credit (the households located within the servicing area of 2 MFI branches) with individuals with access to one source of credit (the households located within the servicing area of 1 MFI branch). We use a fuzzy spatial RDD in our analysis where the first stage estimates the impact of a second MFI branch on borrowing and income outcomes. For the second stage, we estimate the impact of the debt on the four psychosocial wellbeing indicators such as overall happiness, life satisfaction, financial satisfaction and health satisfaction. The fuzzy RDD approach is taken only because of the second research question that we address regarding impact of outstanding debt on psychosocial wellbeing of clients.

We use the 2014 WiLCAS and the branch location of the three largest MFIs, ASA, BRAC and Grameen Bank, in this study. In this study, we add ASA, the third largest MFI, along with BRAC and Grameen Bank. This is because around 70% of the MFI loans taken by the respondents were from these three institutions. The survey has a module including detailed record of microfinance borrowing of the respondents including information on their MFI membership, list of loans taken with respective years and whether they had repaid the loan in full at the time of the survey. This allows us to study outstanding debt (amount and number of outstanding loans) and delinquent debt (amount and number of delinquent loans). We measure outstanding debt as total debt which the borrowers had not repaid in full at the time of the survey. Delinquent debt is measured as total debt that a borrower had failed to repay within the period of repayment schedule. We find that an additional source of credit lowers outstanding debt both in amounts and number of outstanding loans. However, there is no subsequent effect of the lowered debt on psychosocial wellbeing of borrowers. We find no effect on an additional source of credit on monthly income. Our results do not provide any evidence of a negative impact on debt when access to credit is expanded. In addition, this implies that debt has no negative impact on borrower welfare, in terms of psychosocial wellbeing.

In addition to the socio-economic problems addressed in the previous chapters, Bangladesh is historically known to be prone to floods. The country has experienced several catastrophic floods in 1987, 1988, 1998 and 2004. The floods of 1988 and 1998 had been recorded as the worst floods with the highest impact affecting around 30 million people (Brammer, 1990; Rasheed, 2008; Younus, 2010). Along with direct costs of flooding such displacement and morbidity, households exposed to floods face severe deterioration in health and sanitation outcomes due to water-borne diseases. In addition to causing severe malnutrition among children leading to, in extreme, high child mortality (Pelletier et al., 1993; Del Ninno and Lundberg, 2005; Maccini and Yang, 2009), floods impact upon rural infrastructure and, thus, the schooling of children. The World Bank anticipated that hundreds of thousands of children were at risk of falling out of the school system in 1999 after the severe flood of 1998 (BBC, 1998; World Bank, 1999).

There a small literature on the impact of floods in Bangladesh examining consumption smoothing, coping mechanisms, role of relief and aid in cushioning the shock (Rahman, 1989; Haque and Zaman, 1993; Del Ninno et al., 2003; Khandker, 2007). On the other hand, there is a large literature on child mortality in developing countries including Bangladesh (Chowdhury et al., 1976; Edmonston, 1983; Miller et al., 1992; Kabir and Amin, 1993; Muhuri, 1995; Mondal et al., 2009). In addition, there is another strand of literature which suggests that female children are marginalised when households face adverse conditions (Behrman, 1988; Rose, 1999). In addition, a number of studies in the existing literature provides evidence that female infanticide and mortality is often under-reported in South Asia (Behrman and Deolalikar, 1988; Sen, 1990; Sharma, 2003; Filmer et al., 2004).

Inspired by the different strands of the existing literature, in chapter 4 we link the strands and investigate the impact of floods on early life outcomes of children along with testing for prevalence of gender disparity among the poor households in Bangladesh. Furthermore, inspired by the existing evidence suggesting child health is most affected when households are credit-constrained (Foster, 1995; Rashid, 1999), we introduce microfinance access in the analysis. We use three different data sets in third chapter: the 2014 WilCAS, branch location data of BRAC and Grameen Bank and river water level data for the period of 1974-2000 obtained from the Bangladesh Water Development Board (BWDB).

Using spatial and temporal variation in water levels recorded at weather stations close to major rivers in Bangladesh, we derive a binary flood measure that takes a value of 1 if the maximum water level during each year is 1 standard deviation or more above the long-run average of the annual maximum water level and takes the value of 0 otherwise. In addition, we construct two flood count variables; the first indicates the number of occasion the children had experienced flooding between the ages of zero and five when mothers do not have access to credit; the second provides a corresponding measure for periods when mothers had access to credit . We calculate the distance of the households to the flood stations and divide the sample into quartiles based on the distance. The quartiles determine the extent of flooding for the households. The flood count and extent of flooding represented by the quartiles help us to investigate if flood shocks during birth year and up until the age of five affect school enrollment of children. Furthermore, we estimate the prevalence of gender disparity in mortality of children based on the existing evidence on marginalisation of female children. Building on the methodology of Rose (1999), we examine whether flooding leads to increased female child mortality relative to male child mortality. We add to the existing literature by incorporating access to credit in to the analysis.

Although we hypothesize that flood shock would have negative effect on child outcome, we do not find evidence of any impact of floods in our analysis. In addition, our results do not indicate any effect of access to microcredit on the outcomes studied. However, an alternative measure of flood shocks may show an impact on schooling and child mortality.

The chapters of this dissertation add to the literature by providing evidence on impact of access to microfinance over a diverse range of outcomes. Chapter 2 provides evidence on long-term impact of microfinance on the next generation of microfinance clients. We investigate if the microfinance promise to provide financial inclusion and induce a social development in terms of better education, marriage and labour market outcomes for children, particularly daughters, of borrowers. To the best of our knowledge, this is yet to be explored in the literature. In chapter 3 we estimate the impact of an additional source of credit on outstanding debt of borrowers and its subsequent impact of borrowing on borrowers' welfare. We explore if an additional source of credit increases outstanding debt of borrowers and leads them to indebtedness. In addition, we estimate impact of outstanding debt on psychosocial wellbeing of borrowers in terms of overall happiness, life satisfaction, health satisfaction and financial satisaction. The results of this chapter adds to empirical evidence on the growing literature on over-indebtedness among microfinance clients around the world. To the best of our knowledge, this is the first study to examine the impact of multiple sources of credit. Chapter 4 explores impact of floods in Bangladesh on early-life outcomes of children and prevalence of gender disparity in mortality of children. In addition, we investigate if access to credit allows the borrowers to better cope with exogenous shock such as flooding. This is the first study to link the strands in literature to examine the outcomes in presence of credit access in Bangladesh. The chapters also contribute to the literature by using novel dataset on geo-referenced location of the three largest MFIs in Bangladesh combined with the 2014 WilCAS.

Chapter 2

Women's Access to Microfinance and Child-related Outcomes

2.1 Introduction

Microfinance was recognized by the United Nations as the primary tool for poverty alleviation through financial inclusion of the poor for Millennium Development Goals (MDGs) in mid 1990s (CGAP, 2002). This led to a global 'microfinance revolution' among the developing countries over the next decades reaching a large share of microfinance clients particularly in Bangladesh, India, Philippines and Sub-Saharan Africa, among the other developing countries (Robinson, 2001; World Bank reports, 1992-1995). According to the recent Microfinance Summit, the programme reached around 139 million borrowers in the developing world with South Asia accounting for nearly 60% of the share (Microfinance Barometer, 2018).

Over the past few decades, the microfinance programme drew attention to its motive of poverty alleviation based on positive anecdotal evidence and case studies (Todd, 1996; Sebstad and Chen, 1996; Goldberg, 2005). However, recent literature finds limited positive impact of the programme in different parts of the developing world using randomized controlled trials with different microfinance institutions (See Bauchet et al. (2011) and Banerjee, Karlan and Zinman (2015) for detailed reviews of this literature). While the existing studies provide concrete evidence on the welfare effects of microcredit in the short-term, there is little evidence on its long-term effects, such as outcomes for the next generation.

In this chapter, we add to the existing literature by examining if access to microfinance has translated into an impact on socio-economic indicators for the next generation of the microfinance clients in Bangladesh. Bangladesh has an interesting setting to study the long-term impact of microfinance as it has evolved into a sizable market in the past four decades of microfinance operation. The children of the first generation microfinance clients are now adults which makes it possible to study the long-term social impact of microfinance programmes initiated during the 1970s and the 1980s. 89% of the microfinance borrowers in South Asia are women (Microfinance Barometer, 2019). The microcredit programme, by design, focuses exclusively on women in Bangladesh. 98% of the clients in Bangladesh are women (Institute of Microfinance Report, 2009; MIX, 2013). It is built on the argument that women comparatively perform better on repayment and women's access to credit leads to better socio-economic outcomes for children (e.g. Pitt and Khandker 1998, Garikipati 2008). This gives us a suitable scenario to examine the long term impact of access to credit of first generation microfinance borrowers, henceforth referred to as mothers, on the social outcomes of the next generation, henceforth referred to as children.

In Bangladesh, the microfinance institution (MFI), Grameen Bank, introduced the credit model in mid-1970s with a set of pledges that the borrowers were required to make when joining the organisation. This was done to order to induce a social change along with relieving the financial constraints of the poor. The set of pledges, collectively referred to as '16 Decisions' by the MFI, was inspired from the socio-economic problems that the country was dealing with at the time.[1] Microfinance borrowers had to vow to follow the pledges such as to educate children, to not practice child marriage and to not engage in tradition of dowry, etc. The pledges were expected to affect the prevailing social norms positively despite credit access, relieving financial contraints, could lead to opposite effects.[2] Hence, the microfinance revolution in Bangladesh not only facilitated financial inclusion but aimed to induce a positive social change.

MFIs in Bangladesh, such as Grameen Bank and BRAC, follow an exogenous operational rule of covering a radius of 4 kilometer geographic distance to seek

[1] The list of the pledges is given in Appendix 2.9.1

[2] For instance, access to credit might make it easier for borrowers to pay higher dowry payments for daughters' marriages. However, the sensitivity training of the pledges were expected to override that.

and serve borrowers.[3] This operational rule creates a discontinuity in credit access, and provides the basis for our identification strategy in which we use this quasi-experimental set up to estimate the impact of access to credit using a regression discontinuity design (RDD). The microfinance clients are considered to have access to credit, i.e., be in 'treatment' if they are located within the 4-kilometer radius of the MFIs and to not have access, i.e., be in 'control' if located beyond the radius. Using the record of branch establishment and geo-referenced location of all the branches of the two MFIs combined with a nationally representative household survey of women in Bangladesh, we investigate the impact of access to credit and promotion of these pledges of the programme on education, marriage and labour outcomes of the next generation.

For precise estimation of impact of access to credit, we use variation in the timing of microfinance branch openings of the MFIs – relative to the birth year of the children of potential clients – to identify whether relaxing credit constraints play a more important role for long-term outcomes. As the impact of credit access may impact upon a child differently depending on the child's age, we estimate the impact of credit access of the mother for three different ages of the child. The three time variations used in the analysis are referred to as access to credit at age 1, 8 and 12 throughout the chapter. The social outcomes of children that we investigate are completed years of schooling, primary school completion, secondary school completion, age at marriage, marriage before 15 and marriage before 18. We also look at groom characteristics and income-generating activities for daughters to test for an impact of mother's access to credit. The outcome variables chosen in this study are motivated by the nature of the pledges advocated by the MFIs to achieve sustainable social goals such as better education and marriage outcomes especially for daughters.

Our empirical results show that access to microfinance for clients leads to little impact on social outcomes of children. Access to credit of mothers when the child is aged 1 lowers educational attainment for daughters by approximately 6 months. In addition, the daughter is 9.35 percentage points less likely to complete secondary schooling if the mother has access to credit when the child is one-year old. Furthermore, access to credit of mothers also lowers probability of sons completing secondary school. The sons are 5.75 percentage points less likely to complete sec-

[3] The operational rule varies among MFIs, e.g., Association of Social Advancement (ASA) has an operational rule of covering 5-kilometer radius.

ondary schooling for access to credit at age 1 and 8.58 percentage points less likely to complete secondary schooling for access to credit at age 8.

For the marriage outcomes, access to credit of mothers also lowers the age at marriage of children. Age at marriage of daughters declines by approximately 7 months if the mothers have access to credit when the daughters are 8 years old. It also declines by approximately 4 months for daughters if the mothers have access to credit when the daughters are 12 years old. Daughters are also 8.82 percentage points more likely to be married before the age of 18 if mothers have access to credit when the daughters are aged 8. In addition, age at marriage for sons declines by approximately 5 months if the mothers have access to credit when they are aged 1. We also examine dowry outcome for daughters to examine if access to credit affects the incidence of dowry payments in the marriage of daughters. We do not observe any effect on dowry payments. Access to credit by the mother when a daughter is aged 1 and 8 decreases her groom's education by approximately 1 year. Furthermore, we estimate the impact of the microfinance access of mothers on labour outcome of daughters. We find no impact on the probability of employment in paid work for the daughters in their adulthood.

Our results for educational attainment are in line with the evidence of Augsburg et al. (2015). Augsburg et al. (2015), using a randomized trial, found that adolescent children were taken out of school to work as additional labour when households expand their businesses with the help of access to credit. Access to credit during early life of children enables the households to provide adequate nutrition to children.[4] Better health of children also make them more likely to replace adult labour in productive activities induced by credit access. Futhermore, we find that access to credit of mothers lowers the age at marriage of children and increases probability of daughters of being married before the age of 18 despite the pledges advocating against child marriage. It implies that the credit options indirectly enables the families to bear the cost of wedding of children, especially daughters thus facilitating child marriage. The marriage outcomes fit well with the educational attainment of daughters. Our results align with studies estimating a delay in marriage leading to an increase in educational attainment (and vice versa) among adolescent women (Field and Ambrus, 2008; Mahmud, 2003; Nguyen and Wodon, 2015).

[4]There is a large literature on positive correlation between mother's bargaining power within the household and children's nutrition. This will be discussed in details in the following sections of the study.

In general, our estimation results point towards a weak story of transformative impact of microfinance programmes for a long term effect in the lives of poor in terms of accomplishment of social goals. In this chapter, we add to the literature by studying the long-term impact of microfinance access of women on the social outcomes of their children. Our findings corroborate with the existing evidence for the short run finding limited impact of microfinance (Banerjee, Karlan and Zinman, 2015). Access to credit along with the pledges advocated by the MFIs in Bangladesh did not lead to a substantial positive effect on the next generation of the microfinance clients.

The remainder of the chapter is organised as follows. Section 2 discusses the related literature. Section 3 describes the context and background of the microfinance sector in Bangladesh. Description of the data follows in section 4 leading to section 5 which sets out the identification strategy. The results are reported in section 6 and section 7 presents the discussion.

2.2 Related Literature

A number of papers in the literature used qualitative data and concluded, on the basis of qualitative evidence, that access to microfinance had a positive effect on the income/consumption of borrower households (Goldberg (2005) provides a summary of the literature). Hossain (1988) conducted a survey of borrowers of Grameen Bank in Bangladesh where the borrowers reported their socio-economic characteristics. The author found that the borrowers' average household income was around 43% higher than the non-borrowers. The borrowers and the non-borrowers were simply classified by the information whether they had borrowed from MFIs or not. However, the borrowers were found to be better educated than the non-borrowers and the non-borrowers were found to more likely be landless. This was one of the first studies comparing microfinance borrowers and non-borrowers in Bangladesh providing qualitative evidence. Roy and Biswas (2016) conducted in-depth interviews of microfinance borrowers of ASA, BRAC and Grameen Bank in Bangladesh. The authors suggested that children of borrowers were less likely to drop out from school due to availability of educational loans of the MFIs. In another study, Barnes (2001) conducted a survey for a sample of borrowers and non-borrowers in Zimbabwe.

Two years later 87% of the sample was re-interviewed as a follow-up survey. The results suggested that the proportion of boys aged 6 to 16 attending school was higher among the borrowing households after two years. Furthermore, almost none of the borrowing households reported to have sold an asset as a coping strategy in presence of a financial shock. Murthy et al. (2005) conducted semi-structured interviews of a sample of MFI members and non-members in Andhra Pradesh. The report suggests that female members were less likely to report severe malnutrition among female children and female infant death in the year before the survey. Loans to women also had positive effects on expenditure on children, with a stronger effect for girl children. These qualitative studies provided positive impact of microfinance, however did not provide any quantitative evidence.

Pitt and Khandker (1998) conducted a detailed panel survey of 1,798 households of borrowers of BRAC, Grameen Bank and BRDB and non- borrowers in Bangladesh. It is one of the first studies to empirically estimate the impact of micro-credit in Bangladesh. The authors set-up a quasi-experimental strategy, regression discontinuity design, using the landholding eligibility of the program (where half-an acre land was the eligibility criterion to diffentiate control and treatment groups). The study estimated an 18% return to income from borrowing. It also found that a 10% increase in provision of credit to women increased the arm circumference of daughters by 6%. Furthermore, a 1% increase in provision of credit to women increased the height-for-age of boys by 1.42% and of girls by 1.16%. In a following study using the same data, Khandker (1999) found that a 1% increase in loans to women who are members of Grameen Bank increased the probability of school enrolment by 1.9% for girls and 2.4% for boys. In addition, Khandker (2005) used the same data to estimate aggregate impact of microfinance on consumption and poverty in Bangladesh. The authors estimated that microfinance reduced average village poverty level by 1 percentage point each year in program areas. Although these studies causally estimate the impact of microfinance on a range development outcomes including children's education and health, the panel survey followed up for 5 years does not provide information on long-term outcomes such as completed years of schooling of children or health outcomes of children in their adult lives. Furthermore, some studies suggest that these impact evaluations of microfinance in Bangladesh lacked an appropriate control group to be studied as the landholding criterion was widely violated thus jeopardizing the validity of the results (Armendariz de Aghion and Morduch, 2005; Duvendack et al.,2011). These existing studies due to methodological limitations added with data constraints do not provide concrete evidence on long-term impact of microfinance which is the aim of this chapter.

In the recent years, the microfinance literature has experienced a novel intervention. Banerjee et al. (2015) carried out the first randomized evaluation of group-lending microfinance program in rural India. The experiment classified the treatment group with access to be compared to the rest of no-access neighbourhoods. The authors found only 38% take-up of microfinance contracts by households contrary to the popular belief regarding high demand for microfinance. Access to microcredit had a positive impact on business creation. However business profits did not seem to have an effect for average businesses. The experiment was also divided into early access and delayed access to microfinance where branches of the MFI were launched over a span of a year to test for differential impact. The authors found that only the upper tail of early access treatment households had significantly more assets and larger business profits. However, the results converged at the end of the three years for both early and delayed access treatment groups with no significant impact on consumption (a standard measure of household welfare), education, health or women's empowerment reflecting negligible impact of microcredit on the MDGs. Angelucci et al. (2015) conducted a clustered randomized trial of 16, 000 households in Mexico. The authors, examining a large set of outcomes, estimated that approximately 19% of the households took up loans due to microcredit access in treatment clusters leading to growth in businesses. However, this had no corresponding effect on profits or household income. In line with Banerjee et al. (2015), the upper end of the distribution of households showed relatively stronger effects on revenues, profits and household decision-making.

Crepon et al. (2015) conducted an RCT in Morocco where the region had limited access to credit prior to the experiment. The authors estimated that access to credit went up by 13 percentage points due to the intervention. The intervention showed a large effect on self-employment. However, impact on consumption was negligible. The increase in consumption wore off after two years of intial rollout of microfinance branches similar to the one in India. Furthermore, there was no change in income as the business profits were negated by reduced casual labour. Tarozzi et al. (2015) conducted an impact evaluation study in rural Ethiopia where there was little microfinance activity prevailing before the intervention. Three years after the intervention, the clients were 25 percentage points more likely to have loans with an average loan size of around 80 percent of the poverty line in Ethiopian annual consumption terms. However, the increased borrowing did not lead to improvement in socio-economic indicators in the treated areas, such as income-generating activities, child school attendance.

In another study, Attanasio et al. (2015) compared joint-liability and individual-liabilty microcredit contracts in 40 villages across Mongolia. The authors estimated a 10 percentage point increase in entrepreneurship among women with group liability loans. In addition, the study reported that half of all loans taken for the purpose of business creation, for both joint and individual liability contracts, were used up for household consumption. There was no effect on household income. However, the authors found positive effect on food and total consumption. They did not find any effect on individual-contract clients which are more prevalent now. Although Karlan and Zinman (2011) with a randomized credit scoring experiment for marginally creditworthy households in Philippines found no evidence of any larger effect of microcredit on women compared to men.

Augsburg et al. (2015) used another randomized study in Bosnia and Herzegovina to analyze the impact of access to microfinance using a potential sample of borrowers who were marginally rejected by a MFI. The marginal clients were randomly allocated into treatment group where they would receive loans and into control groups where they would not receive loans. This study also looked at social impact of access to credit and found no significant impact for schooling below the age of 16. However, they observed a significant increase in the labor supply of 16-19 year olds in the household businesses which scaled up in the presence of credit. Adolescent children were taken out of school to replace adult labour in familial businesses as it was cheaper for households to do so. The findings of this study suggests that relaxing credit constraints in a setting where labour markets do not function well can lead to increased use of family labour and, consequently, lower schooling for children in the household who provide labour.

However, as mentioned earlier, the randomized control trials, taken as the gold-standard of causal estimation, provide evidence of short-term effects of access to credit. The RCTs are yet quite young to bring in evidence of long-term effects of microfinance. There is limited empirical work done on long-term impact of microfinance access. In addition, the RCTs examine access to credit exclusively with no provision of complementary services including sensitivity education, such as the pledges of the Grameen credit model. In our study, senstivity education, through the set of pledges of the Grameen model, is an essential component among the MFIs in Bangladesh. [5] This chapter aims to add to the existing literature by investigating the impact of microfinance and the pledges promoted by MFIs on the long-term social outcomes of children of borrowers in Bangladesh.

The next section describes the context of microfinance sector in Bangladesh.

2.3 Context of Bangladesh

2.3.1 Microfinance Sector of Bangladesh

Microcredit programme started around the mid-1970s in Bangladesh. Grameen Bank, often referred to as the 'bank to the poor', introduced collateral-free small loans to women in self-selected groups.[6] It was soon followed by Bangladesh Rural Advancement Committee (BRAC), another leading non-government organization, in replicating the programme. It was not until the 1990s that other institutions banked on the microfinance model to start their own credit programme in Bangladesh.[7] These two MFIs have gradually expanded their outreach across Bangladesh over the decades. During the late 1990s the sector faced a sharp growth rate of more than 15% per year (Microfinance Regulatory Authority, 2014). However, BRAC and Grameen Bank were the most promiment MFIs during the period of our study of the first generation borrowers. In terms of geographical outreach, Grameen Bank provides services to 83,458 villages with 2564 branch offices and BRAC provides its services to 70,000 villages with around 2500 branches (Rahman et al, 2012). These two MFIs are the longest operating MFIs in Bangladesh with the largest market share even today with roughly 16 million borrowers together out of the nearly 40 million borrowers of the country (BRAC, 2018; Grameen Bank, 2019; MIX, 2013). The gradual expansion in the number of branches of the MFIs is also reflected in the three time variations of access to credit of women used in this study.

[5] There are a number of papers such as Karlan and Valdivia (2011) and Drexler et al (2010) which study the effects of business training on entrepreneurship of clients. However, the pledges of the programmes in our study address a much broader spectrum of social issues.

[6] Group contracts were prevalent at that time. However, borrowers have individual contracts since the late 1990s (Grameen Foundation, 2009)

[7] For example, Association of Social Advancement (ASA)- another leading NGO- although was established in 1978 but started the microcredit programme in 1991. This has been explained in the Appendix 2.9.2

Female labour force participation has historically been quite low in the region due to high fertility rate and prevailing social norms preventing women from being involved in non-familial employment (Chaudhary, 1979; Khandker,1985). The average female labour force participation rate in 1990 was 23.62%. Gender inequality in the labour market, due to the patriarchal social norms, lowered the economic welfare and social status of women within the household (Kabeer, 2005). Reflecting on the existing socio-economic scenario of women at the time, microcredit was specifically designed for women in Bangladesh to empower them and enhance their bargaining power within the household through economic security (Yunus, 1999). Furthermore, the MFIs suggest that women are better in terms of repayment commitment (as seen during the piloting stage of the program). It also adds that women's access to credit leads to better schooling and nutrition attainment of children (Pitt and Khandker, 1998; Garikipati, 2008; D'espallier et al, 2011; Chakravarty et al, 2013). Grameen Bank and BRAC have nearly identical credit models. Both of the MFIs follow a rule of operation for each branch. The MFI branches cover a radius of 4 kilometers of geographic distance to lend to borrowers. Therefore, women have access to credit when they are located within the distance of 4 kilometers of the servicing area of the MFIs. In addition to faciliating financial inclusion, MFIs aimed to induce a social change in Bangladesh.

2.3.2 The Pledges of Microcredit Model

A conventional microcredit model involves a courtyard meeting where women are handed out loans in Bangladesh (Yunus, 2003).[8] The credit model required a set of pledges to be followed by borrowers to bring a positive change in social norms in rural Bangladesh. The pledges, termed as '16 Decisions', of the model were motivated from the existing scenario of low education, prevalence of child marriage with high fertility and high child mortality rate, and extreme poverty in the mid-1970s in Bangladesh. (Yunus, 1994; Khandker, Khalily, and Khan, 1995).[9]

Low educational attainment especially for women, subsequently leading to high rate of child marriage, was one of the primary problems of the densely-populated

[8]These meetings are not restricted to just the borrowers but are open to all women in the village due to the motive of building social awareness.

[9]Appendix 2.9.1 has the list of the 16 Decisions.

country in the 1980s (Hossain, 2014). School enrollment and retention rates were significantly low with only 8 million students in primary schools among a population of 85 million with less than 20% retention rate in secondary school (Bangladesh Bureau of Statistics reports, 1990-1992). Female enrollment in secondary schools was half of that of boys, with a dropout rate of 65.9% (UNESCO, 1990; Khandker and Samad, 1995). In addition, the country also had one of the world's highest rates of early marriage since 1970s. It has the fourth highest prevalence rate of child marriage in the world, and the second highest number of absolute child bride with 66% of girls getting married before the age of 18 and 29% before the age of 15 (UNICEF, 2019; BRAC, 2019).[10] This phenomenon of early marriage for girls often constrained their access to secondary education (Mahmud, 2003).

The socio-economic background of the country at the time influenced the pledges of the credit model. Each pledge was specifically targeted to induce economic development and positively affect social norms of the country. The decisions dictated pledges to be practised by borrowers in terms of subsistence farming, improvement in health and sanition practices, business creation and most importantly better education for children, no engagement in child marriage and giving up the practice of dowry. Hence, women who had access to microfinance, in terms of being located within the 4 kilometer radius of the operational area of the MFI branches, had exposure to the sensitivity training offered by both of the relevant MFIs. Given the contextual background of inauguration of microfinance in Bangladesh, we hypothesize that access to credit and promotion of the social change should influence social outcomes of children of borrowers positively through different channels.

The next section discusses the conceptual framework of the paper where the mechanisms through which microcredit can cause a shift in social norms and impact development outcomes are discussed.

2.4 Conceptual Framework

In light of financial inclusion and the set of pledges of the microcredit model of the MFIs, there are several mechanisms through which access to credit can affect the social outcomes of the next generation of the borrowers. MFIs came in with a

[10] The legal age of marriage was 18 years of age for girls and 21 years of age for boys.

promise to empower women which (Yunus, 1999). Proponents of microfinance often argue that access to credit mitigates market failures by facilitating financial inclusion of women and empowering them- in terms of higher bargaining power within the households (Karlan and Zinman, 2011).

In addition, women's empowerment has also been found to be correlated with better human capital investment for children (Gupta, 1990; Sastry, 1996; Frost et al, 2005). Our hypotheses, built on the evidence of the exisiting literature, examine the channels financial inclusion of women in Bangladesh could affect the social outcomes of their children. The time variations chosen in this study also help us tap the different mechanisms that contribute towards the outcomes at different phases of children's lives.

The existing literature consists of studies which provide extensive evidence on better decision-making power of mothers improving child health in terms of nutrition attainment and survival of children, especially for daughters in South Asia (Filmer et al, 1998; Sen, 2001; Duflo, 2003; Hossain et al, 2007). Buchmann et al. (2017) in their study in Bangladesh finds that male children compared to female received better investment in terms of food and other privileges due to prevailing cultural norms where they were perceived as long-term assets. In addition, Quisumbing and Maluccio (2003) finds that assets controlled by women at the time of marriage in Bangladesh increase their bargaining power and have a positive impact on the share allocated for education of children, particularly daughters. In line with the evidence from the mentioned studies, for access to credit at age 1, we hypothesize that provision of microfinance for mothers should lead to better health outcomes for children through better investment during the formative years.

Afridi, Mukhopadhyay and Sahoo (2013) finds a strong positive correlation between mother's economic participation and daughter's schooling in India. In addition, Afridi (2010) finds that 1 standard deviation increase in women's empowerment is likely to an increase daughter's education by a month in India. Thus, in line with the literature, we hypothesize that relieving financial constraints of mothers along with greater bargaining power should positively affect schooling outcomes of children and lead to a shift in social norms for female education. Field and Ambrus (2008) using data from Bangladesh finds that adolescent marriage reduces education and delaying marriage subsequently leads to more schooling and literacy. In addition, Mahmud (2003) finds that dropout in secondary schooling is highly correlated with early marriage among girls in Bangladesh. Thus, we hypothesize that a positive impact on schooling outcomes particularly in secondary school completion is expected to subsequently delay age at marriage thus reducing the incidence of marriage before 15 and 18 for girls and vice versa. Our hypotheses on education and marriage outcomes also supported by the pledges of the microfinance model. The 7th and the 11th pledge of the '16 Decisions' of the microfinance model encourage borrowers to educate their children and not practice child marriage (which is only applicable for daughters in the case of Bangladesh).

Amirapu, Asadullah and Wahhaj (2018) finds that women from wealthier families were able to choose better partners through higher dowry payments in Bangladesh (using the same household survey used in this chapter). Thus, as a part of our marriage outcomes we examine if access to credit of mothers leads the daughters to marry better partners. This can be due to two mechanisms. The first, where women in the household have better decision making power to choose better partners for their daughters. The second where daughters of the borrowers will be able to marry potentially better suitors due to higher dowry payments facilitated by credit option of mothers. In addition, the 11th pledge of microfinance model is about giving up the traditional practice of child marriage and dowry payments. The grassroot awareness initiative of the MFIs was designed to cause a positive shift in social norms regarding child marriage and dowry. Thus, we expect the first of the two mechanisms mentioned to play a role in our analysis.

Furthermore, as microfinance is advocated as a tool for financial independence of women, we check if financial independence of mothers leads to better labour market outcomes for daughters in terms of paid work participation. Our hypothesis is also inspired by a study in Uganda which suggests, using a randomised control trial, that vocational training and awareness building on marriage and reproduction led to 4.9 percentage point increase in income generating employment for the treated adolescent girls with an increase in aspired age of marriage and childbearing (Bandiera et al., 2018). Thus, we hypothesize that the financial independence would be likely to cause a shift in the social norm of low female paid work participation prevailing in Bangladesh during the 1980s.

We test the hypotheses with the data described in the next section.

2.5 Data

The analysis of this paper uses two different datasets: the 2014 Women's Life Choices and Attitudes Survey (WiLCAS) and branch data of the MFIs, BRAC and Grameen Bank. The 2014 WiLCAS is a nationally representative survey of women in Bangladesh between the ages of 20 and 39. The survey was conducted by Asadullah and Wahhaj (2018) for a project funded by Australian AID.[11] This household survey is particularly suitable for the analysis of this study.[12] This is because it gives us detailed information on location of birth and the current location of residence of the respondents of the survey. It also gives us a detailed history of the social outcomes of the women in the sample. In addition, as the survey includes information on the siblings of the women, it allows us to compare outcomes across gender to test for prevalence of gender disparity in the social outcomes of children.

The sample of this survey was selected from the 2010 Bangladesh Household Income and Expenditure Survey (HIES) and includes all rural households in HIES with at least one or more female household members aged between 16 and 35 in 2010. In addition, during the second phase of the survey, a random sample of 1,500 sisters of the 6,293 women in the original sample were tracked and interviewed. We pool together the samples of phase 1 and phase 2 and refer to them as respondents. The individual interviews of the women include information on their backgound such as year and place of birth and parental characteristics such as parental landholdings, parental education and mother's membership of MFIs. It also includes education and marriage history information including completed years of schooling, age at marriage, groom characteristics and dowry payments. Furthermore, it gives us information on the women's employment status and occupation.

The survey also includes a module where respondents were asked to provide information about their siblings: background (including birth year), education (including enrollment age, completed years of schooling) and marriage (including age at marriage). It has information on 13,758 brothers and 13,202 sisters of the respondents. We pool the respondents of phase 1 with the sisters, referred to as daughters, to examine impact on social outcomes of daughters of microfinance clients. [13] Infor-

[11]Details about the survey can be obtained from the website www.integgra.com.

[12]Other household surveys in Bangladesh include the Bangladesh Demographic Health Survey (BDHS) and the Household Income and Expenditure Survey (HIES). BDHS does not have any information on microcredit. HIES does not have migration history of respondents.

[13]We do not include the sample of phase 2 respondents in the sample of 'daughters' as phase 2

mation on dowries and groom characteristics are available for respondents but not for siblings. Therefore we use the sample of respondents only when we investigate the impact of mother's access to credit on these outcomes. Groom characteristics represent their characteristics at the time of marriage. We report the results separately for sons and daughters to test for any gender disparity in outcomes of children. [14]

We use the geo-referenced location of birth of each respondent of the survey to identify the union[15] in which she was born in. Amirapu, Asadullah and Wahhaj (2018), using the 2014 WiLCAS, provides evidence on neglible post-marriage migration. The study provides a detailed list of the number of times women migrate. The authors find that the respondents of the survey migrated only once for the purpose of marriage and had resided at the same location post marriage. In addition, the survey has data on where the respondents (daughters of the mothers examined in this chapter) were born, where the respondents lived at the age of 12, where the respondents resided at the time of the survey and, for the case of respondents who were married, where the respondents resided after marriage. This information from the survey confirms that respondents lived at their residence of birth till they were married. This eliminates the chances of migration of children within the extended family. Extrapolating from the information on respondents, we assume that mothers of the respondents have resided at the location of birth of respondents throughout their upbringing. Following this, we further assume that the siblings of the respondents were born at the same location as the respondents. For our analysis, we exclude the children for whom we could not retrieve the geo-coordinates of the union of birth giving us a final sample of 6,442 respondents and 19,718 siblings.[16]

In order to determine access to microfinance of mothers, we collected the branch location data at the union level of all microfinance operating branches across Bangladesh of Grameen Bank and BRAC including the establishment dates of the respective branches. We retrieved 2042 branch locations of BRAC and 2521 branch locations

respondents are listed as sisters of respondents in the sibling module.

[14]For daughters, we primarily look at pre-marriage outcomes. Therefore, location of marriage of daughters, for the ones who are married, does not affect our analysis.

[15]Union is the smallest rural administrative and local government unit in Bangladesh

[16]We matched the union of birth of the respondents in the survey with the geo-referenced union list of Bangladesh Bureau of Statistics (BBS). We could not match 1,352 unions of birth of respondents with the listed unions of BBS. This could be because administrative classification in Bangladesh changed over the past decades. Hence, we could not retrieve the geo-referenced location of birth of these respondents.

of Grameen Bank.[17] We spatially map the geo-referenced branch location of the MFIs at the union level with the union of residence of mothers to calculate the distance of each branch of the MFIs from the respective union headquarters. This will be discussed in detail later in the chapter.

As MFIs have expanded their market penetration over the past few decades through expansion in number of branches, it is unlikely that all branches have had an impact on children's outcomes that we are interested in. Hence, we filter branches for ages of one, eight and twelve of children to derive mothers access to credit. The filters are inspired from the descriptive statistics of the sample.

2.5.1 Descriptive Statistics

Table 2.1 demonstrates some descriptive statistics for respondents, their brothers and their sisters. The mean age of the respondents is 29 years with a standard deviation of around 6 years, average parental landholding is 144 hectares of land (this is equivalent to 1.44 acres of land). The respondents' fathers have, on average, about 3 years of schooling, while the respondents' mothers have, on average, 1.61 years of schooling. Respondents, on average, have 5 years of schooling. 63% of the respondents have completed primary education and 13% of the respondents had completed secondary schooling. This syncs with the national statistics on secondary schooling reported earlier and indicates that there is a high dropout rate for girls in secondary school.

Approximately 95% of the respondents had experienced marriage. On average, respondents were married at the around the age of 16.5. 24% were married before the age of 15 and 68% before the age of 18. This is in line with the traditional practice of child marriage in Bangladesh. Around 56% of the respondents were involved in income generating activities. Income generating activities include paid employment, entrepreneurship or their involvement when the assets are controlled by the women. 43% of the respondents reported that their marriages involved dowry payments in cash or in kind. The husbands of the respondents have on average, 4.62 years of schooling; the husbands' parents had, on average, 1.32 acres of land at the time of the marriage. Approximately 21% of the husbands have a low-paying occupation.

[17] See Appendix 2.9.2 for more details on branch location data.

Low-paying occupation includes employment as a labourer or an artisan.

Table 2.1 also shows the descriptive statistics for the siblings in the sample.

Sisters

The average age of sisters is approximately 30 years with a substantial standard deviation of around 11 years. Average years of education is around 5 years, which is similar to that of the respondents. 60% of the sisters had completed primary education and 13% had completed secondary education. Average age at marriage is roughly 16.50 years with 16% of sisters getting married before 15 years of age and around 52% before 18 years of age.

Brothers

Respondents' brothers, on average, are around 27 years old. They have, on average, around 5.5 years of schooling which is the highest among the siblings. 64% of them have completed primary schooling and 21% of them have completed secondary schooling. This demonstrates a high dropout rate in secondary school. However, the retention rate is higher than the respondents and their sisters. The brothers, on avergae, were married around the age of 22.50 which is the highest among the siblings. Almost none of the brothers were married before the age of 15 and only 3.6% were married before the age of 18.

In addition, the survey includes questions where the respondents were asked whether their mothers are or were members of any MFI and if they had taken any loans during their membership. However, we do not have the record of the years when their mothers became members of the MFIs and the years when the mothers had taken loans from the MFIs. But from the data we can observe that at least 74% of the mothers who were within the servicing area of the MFIs were members of Grameen Bank and BRAC and had borrowed from the MFIs. In addition, 96% of the mothers, overall, with or without access to credit were members of the MFIs. However, as the branches expanded over the four decades, we can observe from the date of establishment they had taken loans beyond the period of our study.[18]

[18]Anecdotal evidence from the branch managers and loan officers of MFIs, particularly Grameen Bank, suggests nearly all women within the operational zones eventually became members with approximately 90% of them taking loans.

2.6 Identification Strategy

Impact of access to credit in terms of bank branches has commonly raised endogeneity concerns (Burgess and Pande, 2005). The concerns hold over the impact of microfinance branches as well. This is mostly because MFIs like commercial banks choose their operational location considering the population density, demand for the product and other feasilibility factors which makes it difficult for causal estimation given the mismatch between operational and non-operational regions (Tarozzi et al, 2015). In this chapter, we address the problem by using regression discontinuity design through an exogenous operational rule of MFIs. A few studies have used regression discontinuity design to study the impact of microfinance in Bangladesh using an eligibility rule based on the borrower's landholdings but the criteria of the forcing variable has its own limitations (Pitt and Khandker, 1998 ; Morduch, 1998; Morduch and Roodman, 2005; Akhtaruzzaman and Farooq, 2016).

This study contributes to the literature by using a spatial regression discontinuity to estimate the intergenerational impact of microfinance where the discontinuity in treatment assignment is geographic: a case in which a boundary splits households into treatment and control groups. The threshold splitting the treatment and control group creates a quasi-experimental set-up. This quasi-experimental set up allows the observations around the cut-off to be 'as good as random'. MFIs in Bangladesh work within a certain radius to seek and serve borrowers. We take advantage of this exogeneous rule of operation of MFIs to act as a cut-off for the forcing variable in our empirical analysis to classify control and treatment groups. Grameen Bank and BRAC cover a radius of 4 kilometer of distance from the branches to give out loans to borrowers. For measuring access to credit in our analysis, the control group is taken to be the households of the mothers which do not have access to any MFI branch. More precisely, the households in the control group without access to credit are not in the range of 4-kilometer radius of any branch of the MFIs. The treatment group in this study is taken to be the households who have access to at least one branch, i.e. the households with access to credit are located within 4 kilometers of at least one MFI branch of either BRAC or Grameen Bank. We construct the running variable of access to credit of mothers by mapping the geo-referenced location of all the operating branches of these MFIs and the location of mothers to calculate the minimum distance of each mother to each of the branches of the MFIs. If the minimum distance of the household of the mother from any branch of MFI is within 4-kilometers, the mother is taken in the treatment group. Similarly, if the minimum distance of the household of the mother from any branch of MFI is beyond 4-kilometers, the mother is considered to be in the control group as she does not reside within the geographical operational area of the MFIs. To the best of our knowledge, this chapter is the first to use spatial discontinuity as the running variable to study the long-term impact of microfinance in Bangladesh.

As our sample covers a period of rapid growth of microfinance in Bangladesh, there is time variation in access to microfinance for the mothers of the survey respondents. We can detect exactly in what year a mother obtained access to the branches of the MFIs using data on MFI branch establishment dates. Using this data, we construct running variables indicating whether the mother of a respondent or her siblings had 'access to microfinance' when her children were aged 1, 8 and 12. The running variable of mother's access to microfinance has been computed individually for respondents, their sisters and their brothers taking their respective ages for filtering the MFI branches.

Mathematically, the running variable is given by the following formula:

$$R_{iy} = min_{b_i}(C_{o(b)} - d_{ib}) \tag{2.1}$$

$$b_i = argmin_b(C_{o(b)} - d_{ib}) \tag{2.2}$$

where R_{iy}= running variable for each mother's access to microfinance, i = mother's household, y= year of access to credit b = MFI branch, $o(b) \in$ indicates the organization to which branch o belongs, either BRAC or Grameen Bank, d_{ib}= distance of mother's household i from branch b, and $C_{o(b)}$= distance threshold of the respective MFI.

As demonstrated by the formula, the running variable is centered at the threshold. Households located beyond the cut-off do not have to access to credit as the minimum distance is beyond 4-kilometers and those within the cut-off has access to one or more MFI branches. For ease of interpretation, centering of the running variable is such that both positive and negative values represent the distance of the household from the servicing area of the nearest MFI. The negative value in the x-axis means that the individuals would have to travel some distance to be within the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

To estimate the impact of mother's access to microfinance on children's socio-economic outcomes, we employ a nonparametric local polynomial method using a sharp regression discontinuity design.[19] We estimate the following equation:

$$Y_{ij} = \alpha + \tau D_{iy} + \beta R_{iy} + \delta X_i + u_{ijy} \tag{2.3}$$

where Y_{ij} denotes the outcome of interest for each mother i and child j. $D_{iy} \in \{0, 1\}$ indicates access to credit such that $D_{iy} = 1$ if $R_{iy} > 0$ and $D_{iy} = 0$ if $R_{iy} < 0$. τ is the coefficient of interest measuring the local average treatment effect. R_{iy} is the centered forcing variable indicating mother's access to credit in the year credit access is considered. X_i is a set of pre-determined covariates of respondents including respondents' age, age-squared, religion, parental education, parental landholdings and dummies for the children's district of birth and u_{ijy} is the error term.

The commonly practised nonparametric method in the RDD literature is local linear regression. The primary advantage of using a nonparametric estimation is that it provides estimates based on observations closer to the cut-off, which is more intuitively appealing as the observations are valid counterfactuals of each other. This reduces some bias that can result from using data farther away from the cutoff to estimate the treatment effects of the intervention.

However, this identification strategy of the running variable will be valid if it checks through the density test for the observations around the threshold. We check for manipulation of the running variable, i.e., self-selection into the treatment to see if the mothers have chosen to live in the areas where they would have access to credit. It is a test to ensure that mothers have not chosen to relocate their residences to live within the operational areas of the MFI branches to avail access to credit. The density of households around the cut-off if continuous would indicate that mothers have not self-selected themselves in the treatment group. The McCrary density test

[19] In this chapter, we use the RD estimation package 'rdrobust' following Calonico et al (2017) which gives us bias-corrected RD estimates using data-driven optimal bandwidth.

is expected to provide evidence of internal validity of the strategy. Figures 2.1-2.3 show the plots for the McCrary test of manipulation of the running variables of mother's access to credit around the threshold for the respondents, sisters and brothers (McCrary, 2008). Although the plots seem to be discontinuous, the range of confidence interval and formal estimation of the test show no discontinuity across the age variations of respondents and sons. However, formal estimation and the plots show discontinuities for daughters for access to credit at ages 8 and 12. However, we assume that the discontinuities do not invalidate the set-up of our study for a few reasons. We use the geo-coordinates of union headquarters for location of birth of children.

The visual discontinuities in the plots in the McCrary test could be because centre of the unions are more densely populated and that is where the MFI branches are usually located. As we move away from the headquarters of the unions the population density decreases. In addition, it is contextually unlikely for households to relocate to MFI treatment areas. This is because land markets do not function well in Bangladesh and land is one of the main, if not only, assets of the poor living in rural areas. Furthermore, given the gradual expansion of branches of the MFIs the poor are unlikely to undertake the huge cost of relocation. Lastly, Amirapu, Asadullah and Wahhaj (2018) provides evidence that women in the survey did not migrate post marriage. The authors observe negligible migration other than the once for the incidence of marriage. Reflecting on the mentioned reasons, we argue that there was no self-selection in the treatment. Hence, we assume a lack of perfect manipulation around the cut-off which provides evidence of internal validity of the setup. For the plots of the McCrary test, we use a distance of 2 kilometers on each side of the cut-off as the data-driven non-parametric bandwidth is always below 2 kilometers in the estimation results.

As robustness checks, we estimate our regression with five pre-determined demographic characteristics to test for discontinuity following Lee (2008). Figures 2.4-2.7 show the plots for demographic characteristics of the respondents: age, mother's education, father's education and parental landholdings. We choose parental characteristics as covariates as there is extensive evidence of parental education especially mother's education influencing educational outcomes of children (Chevalier, 2004; PE Davis-Kean, 2005; Ermisch and Pronzato, 2010). Furthermore, we use parental landholdings as a control variable as landholdings (half an acre of land) is another eligibility criteria of the microfinance program and has been used as the forcing variable for a microfinance impact study (Pitt and Khandker, 1998).

The plots presented in our empirical analysis use data-driven sequence in order to select the number of bins to best represent the discontinuity taking into consideration the variability of data as proposed by Calonico, Cattaneo and Titiunk (2015). The dots represent binned sample means of outcome of interest using fourth order polynomial and uniform kernel. The x-axis of all the plots is access to credit of mothers (as the running variable) taken at a 8-kilometer spectrum with 4 kilometers on each side of the threshold for better demonstration. The negative distance on the plots demonstrate the distance of the households to access a MFI branch and the positive distance represents the distance of the households to the MFI branch that they have access to. For the plots of pre-determined characteristics, we observe no discontinuity at the threshold for age and parental landholdings of respondents. For parental education, we observe negative discontinuity for access to credit at age 1 and a positive discontinuity for access to credit at age 8. In order to address the issue, we use the pre-determined characteristics as controls in our formal RD estimation.

Formal estimation in Table 2.2 reflects the findings of the plots of the characterisitics across the three age filters of respondents.

The next section reports the regression results.

2.7 Results

We present the graphical plots of the outcomes of interest for all groups of children across the three age variations to check for discontinuities, in Figures 2.8-2.26. In Tables 2.3-2.11, we report RD estimates of the effect of mother's access to credit on child-related outcomes including education, marriage and employment in adulthood. To estimate these effects, we split the sample of children into (i) the respondents' brothers (henceforth referred to as the 'sons') and (ii) the respondents' sisters pooled with the respondents themselves (henceforth referred to as the 'daughters' sample). The even columns in the tables include estimates controlled for the pre-determined characteristics of children including their age, age-squared, religion, parental education and landholdings, and district-of-birth fixed-effects. The regression estimates reported in the odd columns use a data-driven bandwidth. The respective data-driven bandwidths are used to estimate the regression specifications in the even columns including the controls for pre-determined characteristics. All the estimates in our analysis which are statistically significant are robust to a broader range of bandwidth away from the data-driven bandwidth.

For educational attainment of children, we look at completed years of schooling. In addition, we construct binay variables to investigate primary school completion and secondary school completion. For primary school completion, the binary variable takes the value of 1 if the child has completed fifth grade of schooling or more and for secondary school completion, the binary variable takes a value of 1 if the child has completed tenth grade of schooling or more. For the marriage outcomes of children, we look at age at marriage of children. In addition, we construct binary variables for marriage before 15 and before 18 to investigate prevalence of child marriage. We report the estimates for only daughters as child marriage is only applicable for girls in Bangladesh. For marriage before 15, the binary variable takes a value of 1 if the child is married by the age of 15. For marriage before 18, the binary variable takes the value of 1 if the child is married by the age of 18. Subsequently, we examine incidence of dowry as a binary variable to tap if access to credit channels towards dowry. We also look at groom characteristics of daughters such as completed years of schooling of husbands, parental landholdings of husbands and the probability of husbands to be employed in low-paying occupation. Low-pay occupation of husbands is denoted by a binary variable which takes the value of 1 if the husband is an artisan or a labourer. The characteristics of the grooms represent their characteristics at the time of marriage. Lastly, we look into economic participation choice of daughters using a binary variable indicating if the daughter has chosen to be involved in income generating activities. We construct a binary variable for this which takes the value of 1 if the daughter is involved in employment and receives payment for her labour.[20]

2.7.1 Educational Attainment of Children

The RD plots for completed years of schooling are shown in Figures 2.8 and 2.9 for the sample of daughters and the sample of sons respectively. The RD plots for

[20] If the daughter is employed as a familial labour does not receive any designated wage in the family business, the binary variable takes the value of 0.

access to credit at age 1 has a negative discontinuity at the cut-off for daughters. In addition, for access to credit at ages 8 and 12, the plots appear to be positively discontinuous for the daughters. The RD plots for the sons across the three age variations appear to have no discontinuity.

A formal RD estimation of completed years of schooling of children is presented in Table 2.3. Mother's access to credit when the child is of age 1 reduces schooling of daughters by approximately 6 months when specification includes controls for covariates (significant at 10% level). We not see any effect for the other age variations for daughters. For the sample of sons, we see no effect of access to credit on mothers on educational attainment across the three age variations.

Figures 2.10 and 2.11 demonstrate the RD plots for primary school completion for children. Similar to the years of schooling, the plots are discontinuous for daughters across the three age variations. Probability of primary school completion appears to decline for acess to credit at age 1 of daughters. On the other hand, probability of primary school completion seems to increase for daughters for access to credit at ages 8 and 12. Primary school completion of sons appear to have no discontinuity across the three age variations. However, the estimates in Table 2.4 for primary school completion do not indicate any effect for daughters or sons across the time variations of credit access of mothers.

In the RD plots presented in Figures 2.12 and 2.13, we can observe similar discontinuities for secondary school completion for daughters across the age variations. Secondary schooling for sons appear to decline when mothers have access to credit at ages 1 and 8. Access to credit at age 12 seems to have no discontinuity for sons.

The estimates are reported in Table 2.6. Secondary schooling results seem to be consistent with years of schooling estimates. Access to credit for the mother when a child is aged 1 year lowers the daughter's probability of secondary school completion by 9.35 percentage points (significant at 10% level) and lowers the son's probability by 5.75 percentage points (significant at 10% level). In addition, for access to credit at age 8, the sons are approximately 8.58 percentage points less likely to complete secondary school when the specification includes controls for covariates (significant at 5% level).

2.7.2 Age at Marriage of Children

Next, we look at age at marriage of children. The RD plots for age at marriage are shown in Figures 2.14 and 2.15. The plots for daughters have small discontinuities across the three age variations. In Figure 2.15, access to credit at age 1 seems to have a large discontinuity for sons.

The estimates in Table 2.6 do not indicate any effect for sons. Access to credit for the mother when a daughter is aged 8 lowers the child's age at marriage by approximately 7 months when the specification includes controls for covariates (significant at 1% level). Access to credit at age 12 also lowers the daughter's age at marriage by approximately 4 months when the specification includes controls for covariates (significant at 5% level). In addition, when the mother has access to credit when the son is aged 1 lowers the child's age at marriage by approximately 5 months when the specification includes controls for covariates (significant at 5% level).

Figures 2.16-2.17 show the plots for the binary variables indicating marriage below 15 and before 18 years of daughters. The plots in Figure 2.16 seem to be fairly continuous across the age variations. Probability of marriage before 18 seems to increase for daughters when mothers have access to credit at age 8 in Figure 2.17 (b). The other age variations in Figure 2.17 appear to be continuous.

The regression estimates are reported in Tables 2.7 and 2.8 for the probability of marriage below 15 or 18 for daughters. We do not see any effect of access to credit of mothers on probability of marriage of daughters below the age of 15 across the three age variations. Access to credit of mother when a daughter is 8 increases the probability of marriage of the child before the age of 18 by 8.82 percentage points when the specification includes controls for covariates (significant at 1% level).

2.7.3 Incidence of Dowry for Respondents

We also investigate the impact of access to credit by the mother on the probability that the daughter's marriage involved dowry payments. For this purpose, we construct a binary variable which takes a value of 1 if the marriage involved any pre-marital transfer from the bride's family to the groom's family in cash or in kind. As we have dowry-related information for survey respondents only and not for their siblings, we conduct this analysis with the sample of respondents. The plots in Figure 2.20 show no discontinuites across all the first two time variations and a small discontinuity for access to credit at age 12.

The estimates, reported in Table 2.9, do not indicate any effect of access to credit of mother on probability that the daughter's marriage involved dowry payments.

2.7.4 Husband Characteristics of Respondents

Then, we look at groom characteristics of respondents to examine if credit access of mothers channels towards better partner for daughters. Figures 2.19-2.21 show plots for three characteristics of the grooms at the time of the marriage: educational attainment, parental landholdings and probability of being involved in low-paying occupation. We observe discontinuities for all three characteristics of grooms when mothers have access to credit when daughters are aged 1. The other age variations for the three outcomes appear to be fairly continuous.

Table 2.10 shows that access to credit of a mother when the child is aged 1 and 8 leads a daughter (or her family) to choose a partner with lower education (by about 1 year) when the specification includes controls for covariates (significant at 10% level). In addition, mother's access to credit when the child is aged 12 leads the daughter to choose a partner who is 4 percentage points more likely to be employed as a labourer or an artisan.

2.7.5 Economic Participation Choice of Daughters

We look into labour market outcomes of daughters to examine if mother's access to microcredit leads daughters to take up employment. The binary variable takes the value of one if the daughter is involved in income generating activities. Figures 2.22 shows the RD plots for the choice of economic participation of daughters across the age variations. We do not observe any discontinuity across the variations for the daughters.

Table 2.11 shows the formal estimates for the probability of the daughters to be participating in economic activities. We do not observe any effect across the three age variations.

The results for social outcomes of children when mothers have access to microfinance demonstrate impact on a few outcomes across the age variation of children. Access to credit of mothers when the daughters are aged 1 lowers years of schooling for daughters by 0.62 years. We do not see any effect for primary school completion of children when mothers have credit access. Secondary school completion declines by 9.35 percentage points for daughters for access to credit at age 1. Access to credit of mother when a child is aged 1 and 8 lowers secondary school completion of sons by 5.75 percentage points and 8.58 percentage points respectively.

For access to credit at ages 8 and 12, age at marriage declines for daughters by approximately 7 months and approximately 4 months respectively. Age at marriage of sons declines by approximately 5 months when the mother has access to credit (access to credit at age 1). We do not see any effect for marriage before 15 of daughters when mothers have credit access. The probability of marriage before 18 of daughters increases by 8.82 percentage points when the mother has access to credit at age 8. We do not see any effect on probability of marriages of daughters involving dowry payments when mothers have access to credit. To examine whether access to credit affects the groom choice for daughters, we look into groom characteristics such as education, parental landholdings and probability of low-pay occupation of grooms. We find that daughters choose husbands with lower education of about a year when the mothers have access to credit when daughters are aged 1 and 8. Furthermore, daughters choose to marry grooms who are 4.04 percentage points more likely to be labourers or artisans when mothers have access to credit when daughters are aged 12. We find no effect of access to credit by mothers on the employment outcomes of daughters in their adulthood.

As we are testing multiple theoretical hypotheses at three different time variations of access to credit of mothers, as a robustness check, we report the Bonferroni corrected p-values for a more conservative approach. Tables 2.12- 2.20 in Section 2.9.3 in Appendix reports the Bonferroni corrected results. We use 10% of significance to be the threshold for all the outcomes. In the case of daughters, for each age variation, we take the number of outcomes tested for the same hypotheses to be 7.[21] Therefore, in order to declare a result significant for daughters, we need to find p-value $< 0.10/7=0.014$. Similaryly, for sons for each age variation, we take the number of outcomes to be 4. In order to declare a result significant for sons, we

[21]We exclude the outcomes tested for respondents only.

need to find p-value $< 0.10/4=0.025$. In the case of respondents, we take the number of outcomes to be 4. For respondents to declare a result significant at the 10% level, we need to find p-value $< 0.10/4=0.025$ (same as sons). Years of schooling, age at marriage and marriage before 18 outcomes for daughters are significant after correcting the p-values according to Bonferroni method.

2.8 Discussion

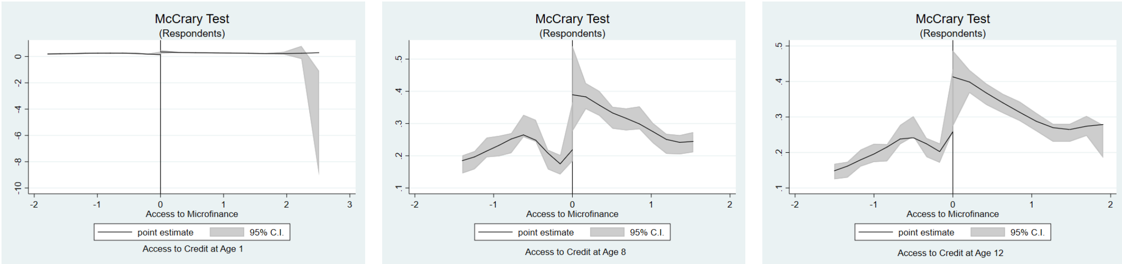
Microfinance has been in Bangladesh for more than four decades. Hence, the country due to the programme's tenure and large share of clients creates an ideal scenario to examine long-term impact of microcredit. Taking advantage of an exogenous rule of operation of MFIs to operate within a 4-kilometer radius, we use a quasi-experimental set up to estimate the causal effect of access to microcredit on the long-term outcomes of children of first generation microfinance clients. We use 3 different time variations of access to credit of mothers to examine if credit access at ages 1, 8 and 12 of children plays a differential role in shaping up the long-term social outcomes. Our outcomes of interest, such as educational attainment and marriage, are motivated by the nature of the pledges advocated by the programme. The pledges 7 and 11 inspire our outcomes which encourage the borrowers to educate their children, not practise child marriage and not engage in dowry payments. We find limited evidence of a positive long-term impact of microfinance in Bangladesh.

Access to credit seems to have a negative effect on educational attainment of daughters: we estimate that completed years of schooling decline by about 6 months. We also find that children less likely to complete secondary school when mothers have access to credit when the children are aged 1. Daughters are around 9.35 percentage points less likely and sons are around 5.75 percentage points less likely to complete secondary school when mothers have access to credit when the children are one year old. This aligns with the counterintuitive evidence of the RCT in Bosnia and Herzegovina finding that children between the age of 16-19 tend to work as additional labour when households expand existing businesses in presence of credit options (Augsburg et al., 2015). Access to credit of mother when children are a year old may positively affect health of children. This could be because access to credit increases the bargaining power of women within the household. Studies have found that financial independence of mothers increases nutrition allocation of children which improves child health (Filmer et al.,1998; Duflo, 2003; Buchmann et al.,2017). This could indirectly lead children to work in adolescent age as healthy children are more likely to subsitute adult labour in productive activities carried out by the household. Futhermore, Beegle, Dehejia and Gatti (2006) in Tanzania and Guarcello et al. (2003) in Guatemala found that households in presence of income shocks or self-reported credit rationing increase use of child labour, subsituting adult labour, which in effect reduces school attendance of children.

In addition, age at marriage declines for children when mothers have access to credit. It declines for daughters by 7 months for access to credit at ages 8 and 4 months for access to credit at age 12. For sons, age at marriage declines by 5 months for access to credit at age 1. This could imply that financial access provides a way for the households to bear the cost of wedding of daughters. Thus, credit access to mothers allows them to wed off their daughters sooner. There is a strand of literature suggesting that families of brides have to pay lower dowries for younger brides (Parsons et al., 2015). Studies suggest that child brides are preferred as they have lower decision-making power due to young age and under-education (Caldwell et al., 1983; Thorton, 2003; Malhotra et al., 2011; Vogelstein, 2013). Furthermore, our results are in line with existing studies providing extensive evidence of early marriage leading to lower educational attainment and vice versa in Bangladesh (Mahmud, 2003; Field and Ambrus, 2008). We also examine the groom characteristics of respondents such as education, parental landholdings and probability of employed as a labourer or an artisan. We find that access to credit at ages 1 and 8 leads daughters to choose groom with lower education by about a year. This could be a subsequent effect of early marriage and low education of the daughters. For the labour market outcomes of daughters, we see no effect on their probability of being involved in income generating employment neither for respondents nor their sisters.

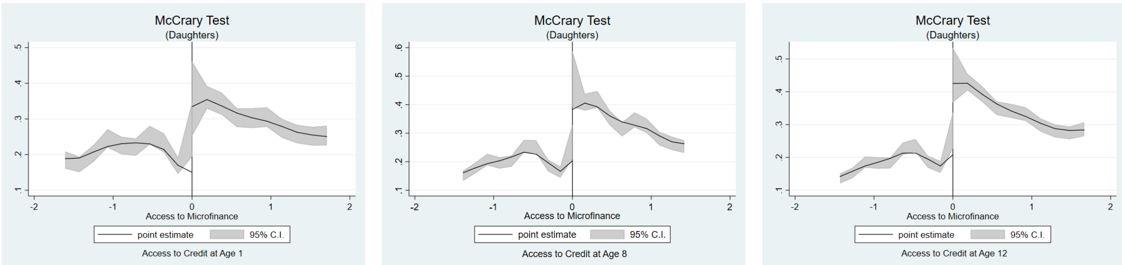
It is interesting to observe that access to credit along and the pledges advocated by the MFIs did not translate into an improvement in social outcomes of the children. Our results align with the recent set of randomized controlled trials on impact of microfinance (Banerjee et al., 2015). Consistent with these studies, which show limited effects in the short term, we find modest effects of microcredit on long term outcomes. In this chapter, we find no remarkable transition in poverty level neither a shift in social norms for the long-term social outcomes of children of first generation of microfinance clients in Bangladesh. Over the decades, the social development outcomes of Bangladesh have improved significantly in line with the MDGs. Female enrollment in primary school has risen remarkably from 47% to 98% from 1980 and 2000 (Chowdhury et al, 2002; Asadullah and Chaudhary, 2009). Secondary school completion made a considerable progress reaching approximately 59% with female dropout rate declining to 43% in 2015 (Bangladesh Bureau of Educational Information and Statistics report, 2015). However, it can hardly be accounted as success of the microfinance sector of the country which came along to promote financial inclusion of the poor to bring them out of poverty and induce a positive effect on socio-economic indicators.

Figure 2.1: McCrary Test of Running Variable: Respondents



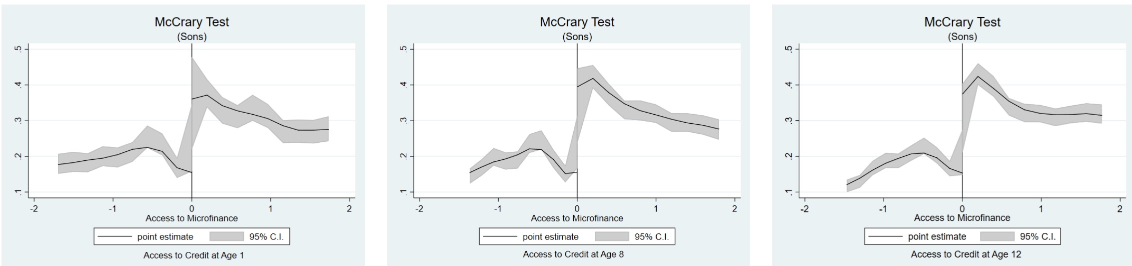
(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

Figure 2.2: McCrary Test of Running Variable: Daughters



(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

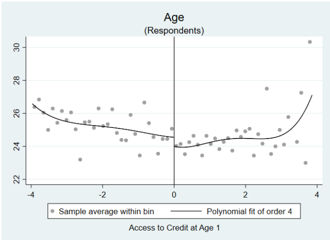
Figure 2.3: McCrary Test of Running Variable: Sons



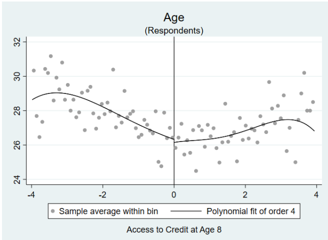
(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

Note: The figures above show the McCrary density test plots for the running variable to check for manipulation of treatment. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

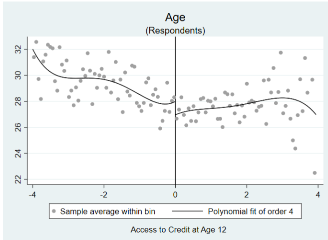
Figure 2.4: Pre-Determined Characteristics of Respondents: Age



(a) Access to Credit at Age 1

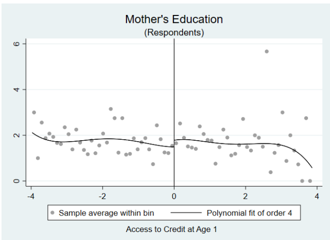


(b) Access to Credit at Age 8

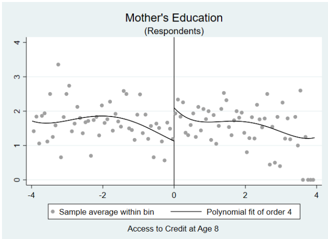


(c) Access to Credit at Age 12

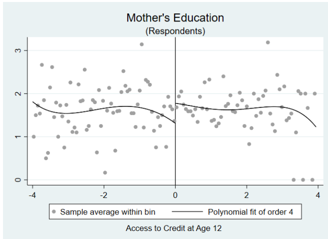
Figure 2.5: Pre-Determined Characteristics of Respondents: Mothers Education



(a) Access to Credit at 1

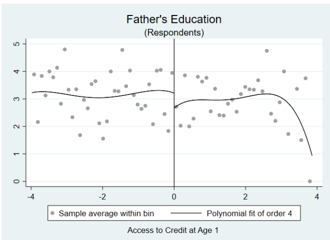


(b) Access to Credit at Age 8

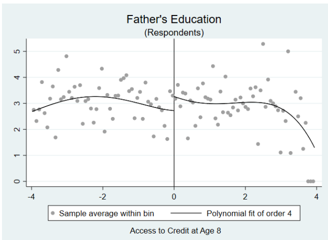


(c) Access to Credit at Age 12

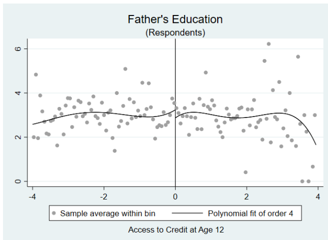
Figure 2.6: Pre-Determined Characteristics of Respondents: Fathers Education



(a) Access to Credit at Age 1

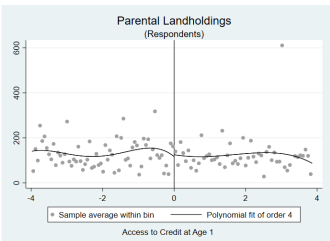


(b) Access to Credit at Age 8

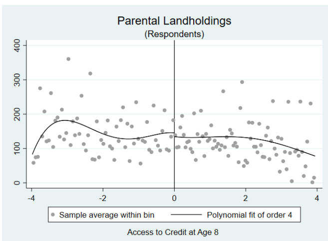


(c) Access to Credit at Age 12

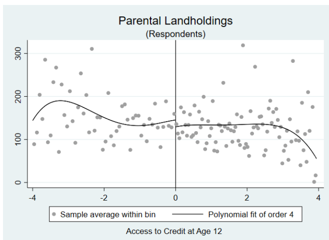
Figure 2.7: Pre-Determined Characteristics of Respondents: Parental Landholding



(a) Access to Credit at Age 1



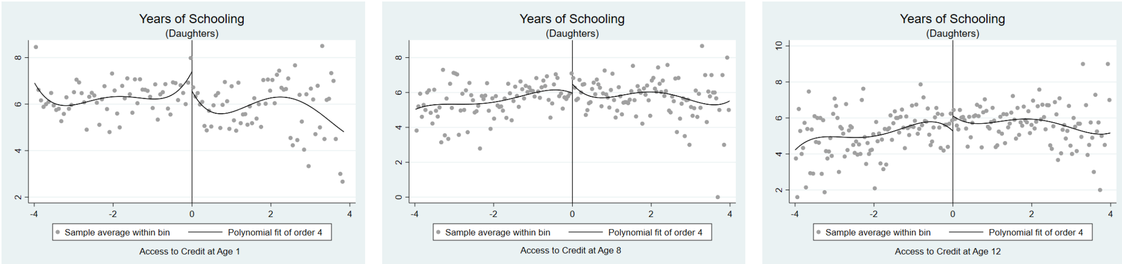
(b) Access to Credit at Age 8



(c) Access to Credit at Age 12

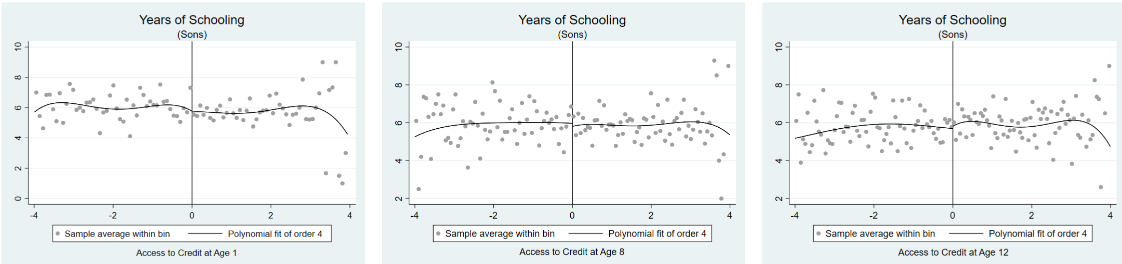
Note: The figures above show the RD plots for pre-determined characteristics of respondents. The dots represent binned sample means of years of schooling using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

Figure 2.8: Years of Schooling: RD Plots for Daughters



(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

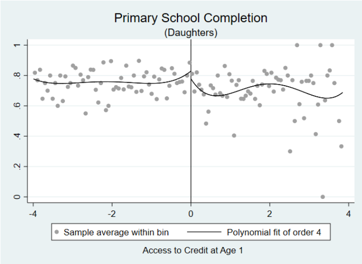
Figure 2.9: Years of Schooling: RD Plots for Sons



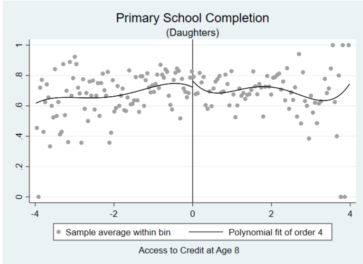
(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

Note: The figures above show the RD plots for years of schooling when mothers have access to credit for the age filters 1, 8 and 12. Figure 2.8 shows the RD plots for respondents and their sisters together as pooled sisters and Figure 2.9 for their brothers. The dots represent binned sample means of years of schooling using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

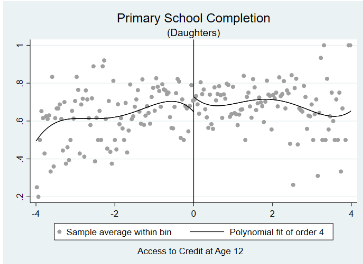
Figure 2.10: Primary School Completion: RD Plots for Daughters



(a) Access to Credit at Age 1

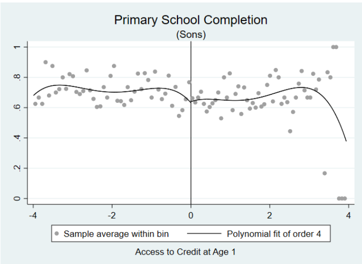


(b) Access to Credit at Age 8

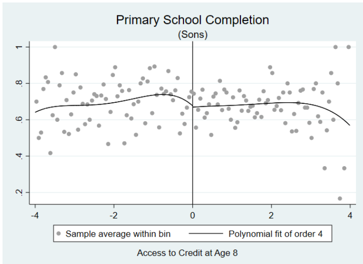


(c) Access to Credit at Age 12

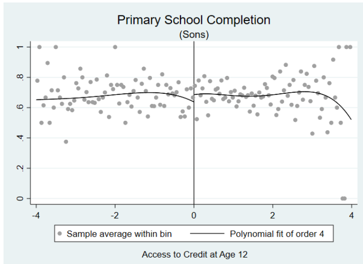
Figure 2.11: Primary School Completion: RD Plots for Sons



(a) Access to Credit at Age 1



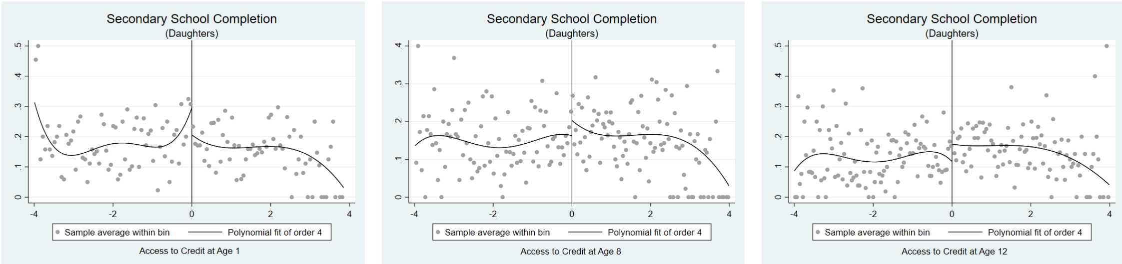
(b) Access to Credit at Age 8



(c) Access to Credit at Age 12

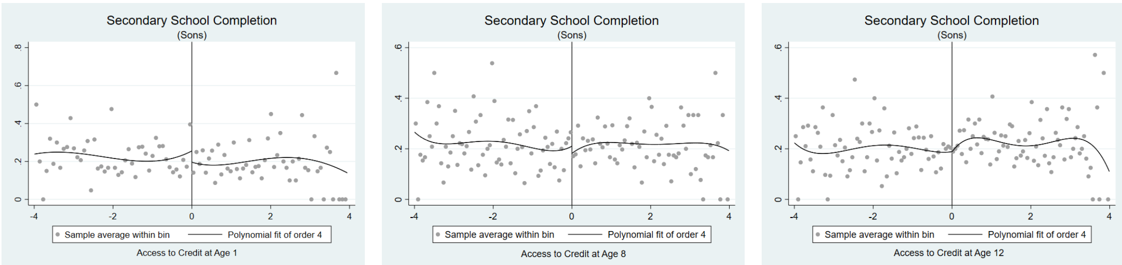
Note: The figures above show the RD plots for primary school completion when mothers have access to credit for the age filters 1, 8 and 12. Figure 2.10 shows the RD plots for respondents and their sisters together as pooled sisters and Figure 2.11 for their brothers. The dots represent binned sample means of binary outcome variable to denote if the children have completed 5 years of schooling or more using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

Figure 2.12: Secondary School Completion: RD Plots for Daughters



(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

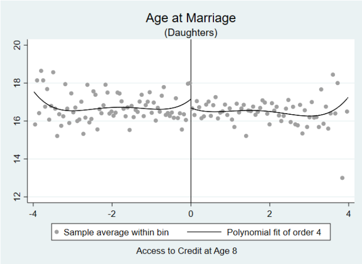
Figure 2.13: Secondary School Completion: RD Plots for Sons



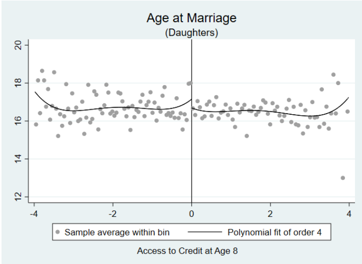
(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

Note: The figures above show the RD plots for secondary school completion when mothers have access to credit for the age filters 1, 8 and 12. Figure 2.12 shows the RD plots for respondents and their sisters together as pooled sisters and Figure 2.13 for their brothers. The dots represent binned sample means of binary outcome variable to denote if the children have completed 10 years of schooling or more using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

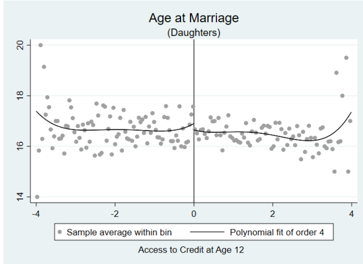
Figure 2.14: Age at Marriage: RD Plots for Daughters



(a) Access to Credit at Age 1

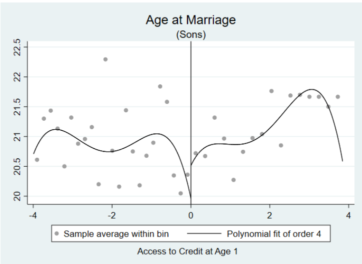


(b) Access to Credit at Age 8

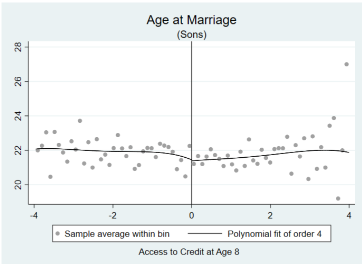


(c) Access to Credit at Age 12

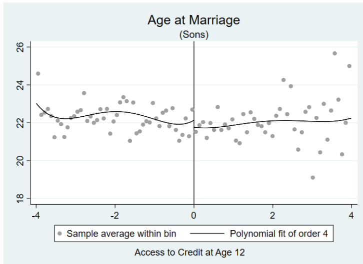
Figure 2.15: Age at Marriage: RD Plots for Sons



(a) Access to Credit at Age 1



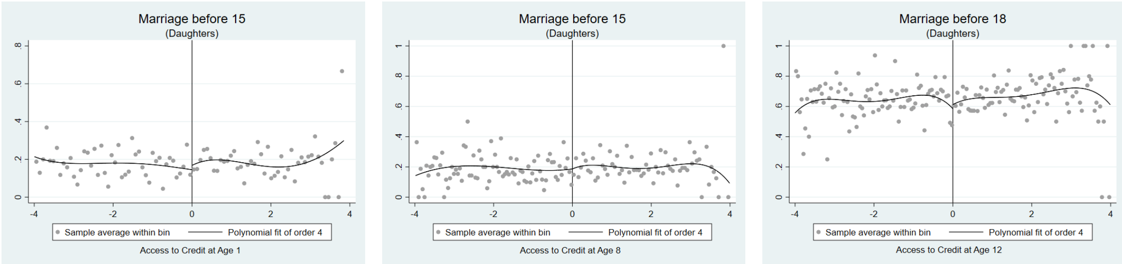
(b) Access to Credit at Age 8



(c) Access to Credit at Age 12

Note: The figures above show the RD plots for age at marriage when mothers have access to credit for the age filters 1, 8 and 12. Figure 2.14 shows the RD plots for respondents and their sisters together as pooled sisters and Figure 2.15 for their brothers. The dots represent binned sample means of age at marriage using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

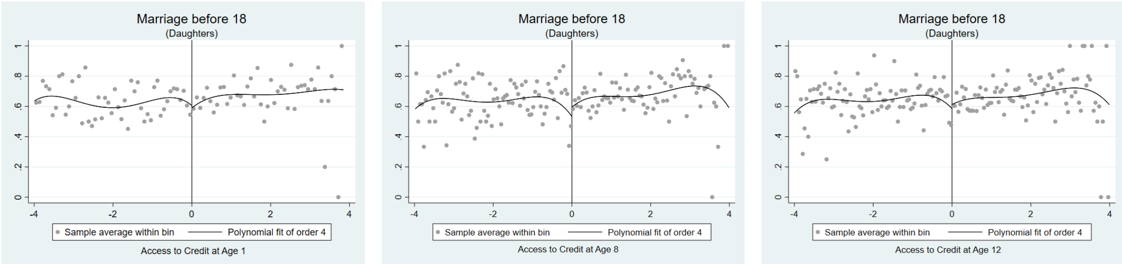
Figure 2.16: Marriage Before 15: RD Plots for Daughters



(a) Access to Credit at Age 1 (b) Access to Credit at Age 8 (c) Access to Credit at Age 12

Note: The figures above show the RD plots for marriage before 15 when mothers have access to credit for the age filters 1, 8 and 12. Figure 2.16 shows the RD plots for respondents and their sisters together as pooled sisters and Figure 2.17 for their brothers. The dots represent binned sample means of binary outcome variable to denote if the children have married before the age of 15 using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

Figure 2.17: Marriage Before 18: RD Plots for Daughters



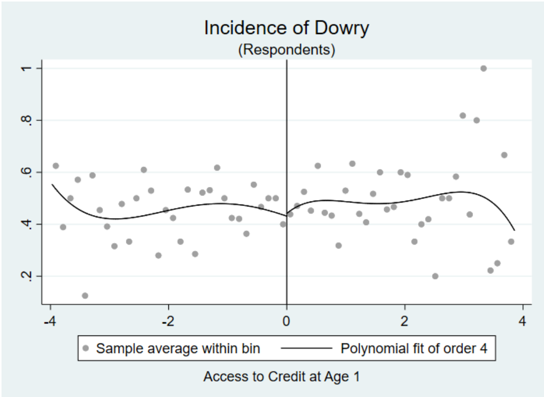
(a) Access to Credit at Age 1

(b) Access to Credit at Age 8

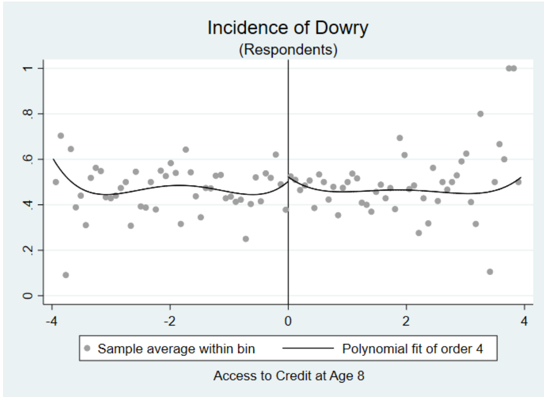
(c) Access to Credit at Age 12

Note: The figures above show the RD plots for marriage before 18 when mothers have access to credit for the age filters 1, 8 and 12. Figure 2.18 shows the RD plots for respondents and their sisters together as pooled sisters and Figure 2.19 for their brothers. The dots represent binned sample means of binary outcome variable to denote if the children have married before the age of 18 using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

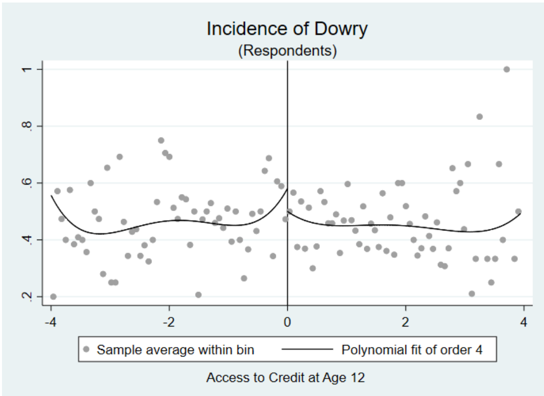
Figure 2.18: Dowry: RD Plots for Respondents



(a) Access to Credit at Age 1



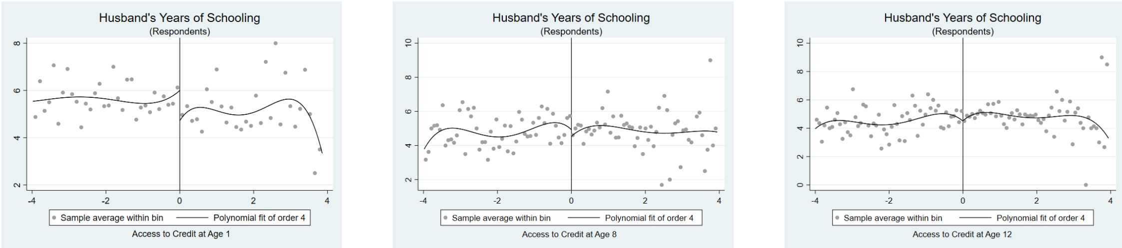
(b) Access to Credit at Age 8



(c) Access to Credit at Age 12

Note: The figure above shows the RD plots for incidence of dowry for respondents when mothers have access to credit for the age filters 1, 8 and 12. The dots represent binned sample means of binary outcome variable to denote if any pre-marital transfer was involved during the marriage of respondents using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

Figure 2.19: Husband's Years of Schooling: RD Plots for Respondents

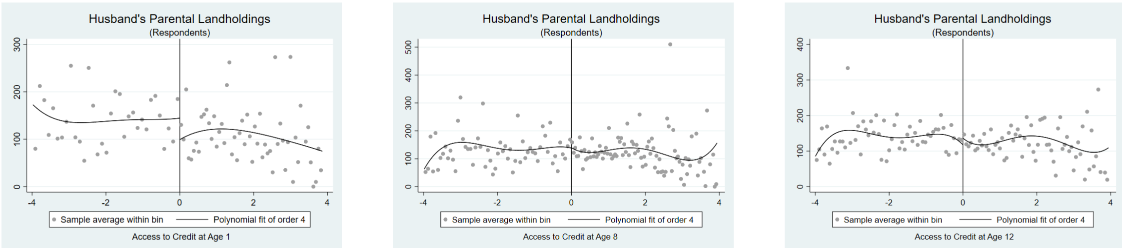


(a) Access to Credit at Age 1

(b) Access to Credit at Age 8

(c) Access to Credit at Age 12

Figure 2.20: Husband's Parental Landholding: RD Plots for Respondents

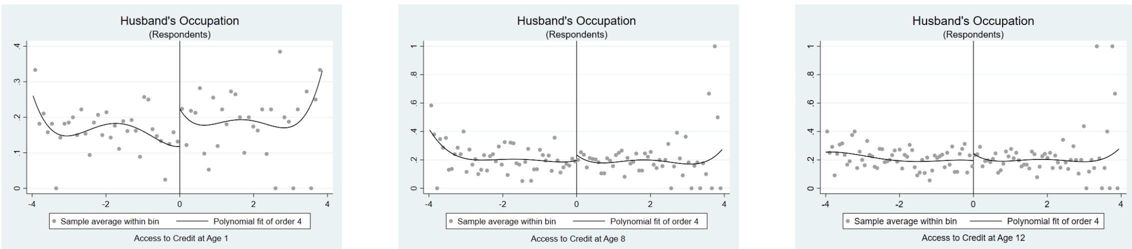


(a) Access to Credit at Age 1

(b) Access to Credit at Age 8

(c) Access to Credit at Age 12

Figure 2.21: Husband's Occupation: RD Plots for Respondents



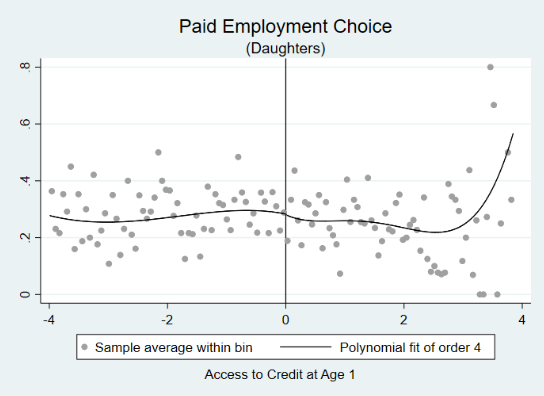
(a) Access to Credit at Age 1

(b) Access to Credit at Age 8

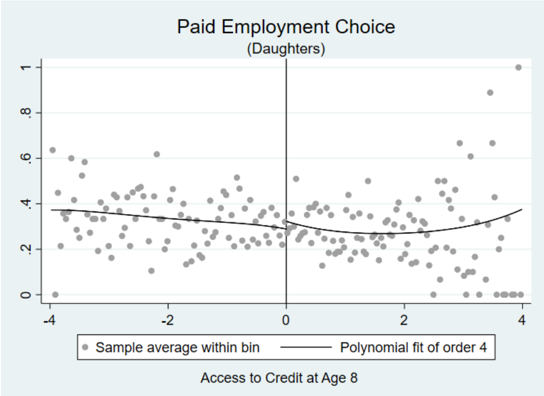
(c) Access to Credit at Age 12

Note: The figures 2.21-2.23 above show the RD plots for characteristics of husbands of respondents when mothers of respondents have access to credit for the age filters 1, 8 and 12. Figure 2.21 has the plots for years of schooling completed by the husbands, Figure 2.22 has the plots for parental landholdings of the husbands at the time of marriage and Figure 2.23 has the plots for husbands occupation using a binary variable denoting if the husband is employing in a low paying job. The dots represent binned sample means of groom characteristics of respondents using a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

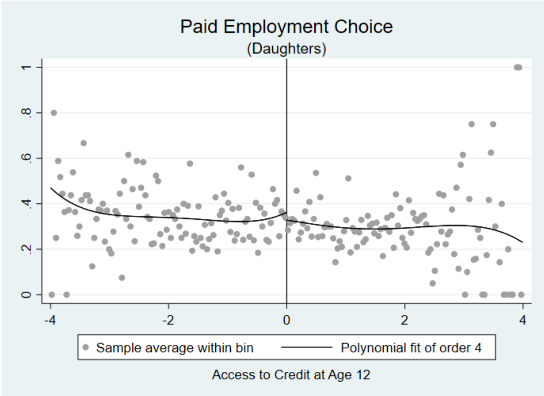
Figure 2.22: Economic Participation Choice: RD Plots for Daughters



(a) Access to Credit at Age 1



(b) Access to Credit at Age 8



(c) Access to Credit at Age 12

Note: The figures above show the RD plots for employment choice of daughters when mothers have access to credit for the age filters of 1,8 and 12. The dots represent binned sample means of binary variable for employment choice to denote if daughters chose to pursue income-generating employment. The plots use a fourth order polynomial and uniform kernel. The plots shown here have the running variable 'access to microfinance' normalized at the cut-off. The mid-point of the x-axis shows the cut-off of 4-km operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of a MFI branch. The positive value in the x-axis means that the individual is already within the servicing area of at least 1 MFI branch. The control group, with the negative distance, has access to no branch of MFI and the treatment group, with the positive distance, has access to at least 1 MFI branch.

Table 2.1: **Descriptive Statistics**

	Mean	Sd	Min	Max	N
Respondents Features					
Age (years)	29.17	5.65	19	39	5007
School Enrollment Age	6.51	0.76	4	10	5007
Parental Landholding (in hectares)	145.67	290.05	0	6000	5007
Mother's Education (in years)	1.58	2.72	0	13	5007
Father's Education (in years)	2.95	3.87	0	13	5007
Religion (muslim; non-muslim)	0.89	0.31	0	1	5007
Age of Menarche	12.66	0.92	9	20	5007
Years of Schooling	5.24	3.76	0	13	5007
Primary School Completion	0.63	0.48	0	1	5007
Secondary School Completion	0.13	0.34	0	1	5007
Age of Marriage	16.44	2.72	10	32	4739
Marriage before 15	0.24	0.43	0	1	4739
Marriage before 18	0.68	0.47	0	1	4739
Incidence of Dowry	0.44	0.50	0	1	4743
Economic Participation Choice	0.57	0.50	0	1	5007
Husband's Years of Schooling	4.62	4.17	0	13	4748
Husband's Parental Landholding (in hectares)	132.19	229	0	3300	4748
Husband's Occupation	0.21	0.40	0	1	5007
Sisters Features					
Age	29.92	10.96	0	52	7637
Years of Schooling	4.91	3.73	0	13	7637
Primary School Completion	0.60	0.49	0	1	7637
Secondary School Completion	0.13	0.34	0	1	7637
Age of Marriage	16.49	2.52	9	34	6329
Marriage before 15	0.20	0.40	0	1	6329
Marriage before 18	0.67	0.47	0	1	6329
Brothers Features					
Age	26.74	10.62	0	52	7941
Years of Schooling	5.61	3.95	0	13	7941
Primary School Completion	0.65	0.48	0	1	7941
Secondary School Completion	0.21	0.41	0	1	7941
Age of Marriage	22.44	3.38	12	38	5347
Marriage before 15	0.002	0.05	0	1	5347
Marriage before 18	0.034	0.18	0	1	5347

Source: WiLCAS 2014, BRAC and Grameen Bank branch data and Authors Calculation

Note: The sample of respondents include the sample of phase 1 and the sample of phase 2. The samples of brothers and sisters refer to the sample of the module on siblings of the phase 1 respondents.

Table 2.2: **Pre-Determined Characteristics of Respondents**

	Age	Religion	Mother's Education	Father's Education	Parental Landholdings
Access to Credit at Age 1	-0.6036	-0.0018	0.2574	-0.352	-5.0049
	(0.508)	(0.041)	(0.382)	(0.509)	(34.319)
h	1.393	1.059	1.484	1.529	1.096
Obs around cutoff	[967, 912]	[967, 912]	[967, 912]	[967, 912]	[967, 912]
N	1879	1879	1879	1879	1879
Access to Credit at Age 8	-0.3789	-0.0374	0.8246**	0.4042	-21.9810
	(0.459)	(0.028)	(0.325)	(0.457)	(24.205)
h	1.081	0.965	0.950	0.988	1.148
Obs around cutoff	[1624, 1829]	[1624, 1829]	[1624, 1829]	[1624, 1829]	[1624, 1829]
N	3453	3453	3453	3453	3453
Access to Credit at Age 12	-0.7670	-0.0225	0.3816	-0.1544	-17.0860
	0.525	(0.027)	(0.278)	(0.362)	(23.209)
h	0.921	0.953	1.105	1.328	0.990
Obs around cutoff	[1763, 2410]	[1763, 2410]	[1763, 2410]	[1763, 2410]	[1763, 2410]
N	4173	4173	4173	4173	4173

Note: The table presents the local linear regression estimates for the pre-determined covariates of the respondents. The access to credit age variations shown in this table and all the following tables represent credit access of mothers at age 1, 8 and 12 of children. The sample of respondents include sample of phase 1 and phase 2. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. h is the bandwidth taken around the threshold for estimation. Standard errors are given in parantheses. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.3: **Years of Schooling: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	-0.9685**	-0.6168*	-0.1744	-0.2390
	(0.353)	(0.243)	(0.403)	(0.341)
h	0.847	1.400	1.441	1.441
Obs around cutoff	[2138, 2424]	[2138, 2424]	[1372, 1686]	[1372, 1686]
N	4562	4562	3058	3058
Access to Credit at Age 8	0.0495	-0.1318	-0.1283	-0.5082
	(0.263)	(0.227)	(0.333)	(0.309)
h	1.105	1.105	1.322	1.322
Obs around cutoff	[3009, 4215]	[3009, 4215]	[1849, 2837]	[1849, 2837]
N	7224	7224	4686	4686
Access to Credit at Age 12	0.3551	0.1265	0.0774	-0.2639
	(0.249)	(0.220)	(0.399)	(0.364)
h	1.001	1.001	0.858	0.858
Obs around cutoff	[3274, 5296]	[3274, 5296]	[2019, 3522]	[2019, 3522]
N	8570	8570	5541	5541
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of completed years of schooling for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons includes the brothers of the phase 1 respondents. The estimates in column (2) and (4) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4: **Primary School Completion: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	-0.0673	-0.0135	-0.0199	-0.0065
	(0.042)	(0.035)	(0.054)	(0.048)
h	0.924	1.100	1.289	1.289
Obs around cutoff	[2138, 2424]	[2138, 2424]	[1372, 1686]	[1372, 1686]
N	4562	4562	3058	3058
Access to Credit at Age 8	-0.0080	-0.0083	-0.0234	-0.0328
	(0.033)	(0.029)	(0.043)	(0.041)
h	1.128	1.128	1.200	1.200
Obs around cutoff	[3009, 4215]	[3009, 4215]	[1849, 2837]	[1849, 2837]
N	7224	7224	4686	4686
Access to Credit at Age 12	0.0308	0.0197	0.0458	0.0212
	(0.032)	(0.029)	(0.043)	(0.041)
h	1.008	1.008	0.999	0.999
0.754 Obs around cutoff	[3274, 5296]	[3274, 5296]	[2019, 3522]	[2019, 3522]
N	8570	8570	5541	5541
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of primary school completion for for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons include the brothers of the phase 1 respondents. Primary school completion is taken as a binary indicator set to 1 if the children have completed 5 years of schooling or more and 0 otherwise. The estimates in column (2) and (4) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5: **Secondary School Completion: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	-0.1000**	-0.0935*	-0.0471	-0.0575*
	(0.050)	(0.041)	(0.044)	(0.039)
h	0.839	1.100	1.543	1.543
Obs around cutoff	[2138, 2424]	[2138, 2424]	[1372, 1686]	[1372, 1686]
N	4562	4562	3058	3058
Access to Credit at Age 8	0.0181	-0.0128	-0.0390	-0.0858**
	(0.031)	(0.026)	(0.044)	(0.042)
h	1.092	1.092	0.959	0.959
Obs around cutoff	[3009, 4215]	[3009, 4215]	[1849, 2837]	[1849, 2837]
N	7224	7224	4686	4686
Access to Credit at Age 12	0.0244	0.0085	0.0137	-0.0204
	(0.028)	(0.026)	(0.040)	(0.039)
h	0.972	0.972	0.964	0.964
Obs around cutoff	[3274, 5296]	[3274, 5296]	[2019, 3522]	[2019, 3522]
N	8570	8570	5541	5541
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of secondary school completion for for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons include the brothers of the phase 1 respondents. Secondary school completion is taken as a binary indicator set to 1 if the children have completed 10 years of schooling or more and 0 otherwise. The estimates in column (2) and (4) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.6: **Age of Marriage: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	0.0178	-0.0310	0.2755	-0.4969**
	(0.300)	(0.216)	(0.523)	(0.488)
h	1.079	1.800	0.835	0.835
Obs around cutoff	[1621, 1612]	[1621, 1612]	[536, 533]	[536, 533]
N	3233	3233	1069	1069
Access to Credit at Age 8	-1.1827***	-0.6736***	0.2431	0.2176
	(0.316)	(0.239)	(0.332)	(0.292)
h	0.684	0.900	1.339	1.339
Obs around cutoff	[2598,3168]	[2598,3168]	[1302, 1303]	[1302, 1303]
N	5766	5766	2605	2605
Access to Credit at Age 12	-0.7360***	-0.3661**	-0.1724	-0.2265
	(0.257)	(0.217)	(0.338)	(0.295)
h	0.590	0.800	1.278	1.278
Obs around cutoff	[2926, 4147]	[2926, 4147]	[1352, 1740]	[1352, 1740]
N	7073	7073	3092	3092
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of age at first marriage for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons includes the brothers of the phase 1 respondents. The estimates in column (2) , and (4) include age, age-sq, religion, parental education, parental landholdings of children as controls. District of birth of children dummies are applied as controls in only column (2) for daughters but not in column (4) for sons due to no observations in some districts. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.7: **Marriage before 15: RD Results for Daughters**

	Daughters	
	(1)	(2)
Access to Credit at Age 1	0.0290	0.0585
	(0.043)	(0.034)
h	1.162	1.800
Obs around cutoff	[1621, 1612]	[1621, 1612]
N	3233	3233
Access to Credit at Age 8	0.0322	0.0556
	(0.035)	(0.035)
h	0.745	0.900
Obs around cutoff	[2598,3168]	[2598,3168]
N	5766	5766
Access to Credit at Age 12	0.0000	0.0064
	(0.030)	(0.029)
h	0.953	0.953
Obs around cutoff	[2926, 4147]	[2926, 4147]
N	7073	7073
Controls	No	Yes

Note: The table presents the local linear estimates of incidence of marriage before the age of 15 for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The outcome variable is taken as a binary indicator set to 1 if the daughters have married before the age of 15 and 0 otherwise. We report the estimates for daughters only as very few men were married by the age of 15. The estimates in column (2) include age, age-sq, religion, parental education, parental landholdings of daughters as controls. District of birth fixed-effects are applied in column (2). h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.8: **Marriage before 18: RD Results for Daughters**

	Daughters	
	(1)	(2)
Access to Credit at Age 1	-0.0057	-0.0597
	(0.060)	(0.043)
h	1.057	1.800
Obs around cutoff	[1621, 1612]	[1621, 1612]
N	3233	3233
Access to Credit at Age 8	0.1395***	0.0882***
	(0.052)	(0.043)
h	0.574	0.900
Obs around cutoff	[2598,3168]	[2598,3168]
N	5766	5766
Access to Credit at Age 12	0.1002	0.0434
	(0.045)	(0.043)
h	0.579	0.579
Obs around cutoff	[2926, 4147]	[2926, 4147]
N	7073	7073
Controls	No	Yes

Note: The table presents the local linear estimates of incidence of marriage before the age of 18 for for daughters. The sample of daughters includes sample of phase 1 respondents and their sisters. The outcome variable is taken as a binary indicator set to 1 if the daughters have married before the age of 18 and 0 otherwise. We report the estimates for daughters only as very few men were married by the age of 18. The estimates in column (2) include age, age-sq, religion, parental education, parental landholdings of daughters as controls. District of birth fixed-effects are applied in column (2). h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.9: **Incidence of Dowry: RD Results for Respondents**

	1	2
Access to Credit at Age 1	0.0282	0.0335
	(0.082)	(0.065)
h	1.260	1.270
Obs around cutoff	[881, 811]	[881, 811]
N	1692	1692
Access to Credit at Age 8	0.0175	-0.0029
	(0.059)	(0.052)
h	1.138	1.138
Obs around cutoff	[1535,1691]	[1535,1691]
N	3226	3226
Access to Credit at Age 12	-0.0695	-0.0739
	(0.054)	(0.051)
h	0.984	0.984
Obs around cutoff	[1683, 2244]	[1683, 2244]
N	3927	3927
Controls	No	Yes

Note: The table presents the local linear estimates of incidence of dowry for respondents. The sample of respondents includes the sample of phase 1 respondents and the sample of phase 2 respondents. The outcome variable is taken as a binary indicator set to 1 if there was incidence of any pre-marital cash or in-kind tranfer and 0 otherwise. The estimates in column (2) include age, age-sq, age of menarche, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10: **Husband Characteristics: RD Results for Respondents**

	Education		**Parental Landholdings**		**Occupation**	
	(1)	(2)	(3)	(4)	(5)	(6)
Access to Credit at Age 1	-1.0724*	-1.3017**	-38.4780	-25.4460	0.1104	0.0963
	(0.641)	(0.512)	(50.692)	(39.179)	(0.061)	(0.120)
h	1.159	1.200	1.050	1.100	1.099	1.099
Obs around cutoff	[880, 807]	[880, 807]	[880, 807]	[880, 807]	[967, 912]	[967, 912]
N	1687	1687	1687	1687	1879	1879
Access to Credit at Age 8	-0.4956	-0.9131*	-5.6448	-11.3820	0.0521	0.0715
	(0.469)	(0.401)	(27.742)	(24.248)	(0.048)	(0.044)
h	1.265	1.265	1.204	1.204	1.047	1.047
Obs around cutoff	[1532, 1685]	[1532, 1685]	[1532, 1685]	[1532, 1685]	[1624, 1829]	[1624, 1829]
N	3217	3217	3217	3217	3453	3453
Access to Credit at Age 12	-0.3301	-0.4581	4.8058	5.7878	0.0264	0.0404**
	(0.505)	(0.423)	(21.947)	(19.141)	(0.036)	(0.033)
h	0.821	0.821	1.093	1.093	1.385	1.385
Obs around cutoff	[1688, 2239]	[1688, 2239]	[1688, 2239]	[1688, 2239]	[1763, 2410]	[1763, 2410]
N	3927	3927	3927	3927	4173	4173
Controls	No	Yes	No	Yes	No	Yes

Note: The table presents the local linear estimates of characteristics of marriage partners for respondents. The sample of respondents includes the sample of phase 1 respondents and the sample of phase 2 respondents. The outcome variables in columns (1) and (2) are completed years of schooling of husbands. Columns (3) and (4) have parental landholdings (in hectares) of the groom at the time of marriage of the respondents as outcome variables. Columns (5) and (6) have binary indicators of occupation choice of grooms of respondents at the time of marriage as the outcome variables. The binary indicator denotes if the groom is in a low-pay occupation. The estimates in column (2), (4) and (6) include age, age-sq, age of menarche, religion, parental education, parental landholdings of respondents and district of birth dummies of respondents as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.11: **Economic Participation Choice: RD Results for Daughters**

	Daughters	
	(1)	(2)
Access to Credit at Age 1	0.0043	-0.0070
	(0.042)	(0.039)
h	1.173	1.173
Obs around cutoff	[2138, 2424]	[2138, 2424]
N	4562	4562
Access to Credit at Age 8	0.0383	0.0447
	(0.036)	(0.034)
h	0.992	0.992
Obs around cutoff	[3009, 4215]	[3009, 4215]
N	7224	7224
Access to Credit at Age 12	-0.0191	0.0006
	(0.033)	(0.032)
h	1.047	1.047
Obs around cutoff	[3274, 5296]	[3274, 5296]
N	8570	8570
Controls	No	Yes

Note: The table presents the local linear estimates of employment choice of daughters. The daughters are grouped as respondents and their sisters pooled together. The outcome variable is taken as a binary indicator set to 1 if the daughter is involved in income-generating activity and 0 otherwise. Income generating activities include any form of economic activitiy in which she is control of the income. The estimates in column (2) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the table as the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.9 Appendix for Chapter 2

2.9.1 '16 Decisions' of the Microfinance Model

There is a list of 16 rules to be practised by the microfinance clients of Bangladesh. Grameen Foundation lists them as following:

1. We shall follow and advance the four principles of discipline, unity, courage, and hard work in all walks of our lives.

2. We shall bring prosperity to our families.

3. We shall repair our homes and work towards constructing new houses.

4. We shall grow vegetables all year round. We shall eat plenty of them and sell the surplus.

5. We shall plant as many seedlings as possible during the plantation seasons.

6. We shall plan to keep our families small, minimize our expenditures, and look after our health.

7. We shall educate our children and ensure that they can earn to pay for their education.

8. We shall keep our children and our environment clean.

9. We shall build and use latrines.

10. We shall drink water from tubewells. If they are not available, we shall boil water or use alum.

11. We shall not take any dowry at our sons' weddings, nor shall we give any dowry at our daughters wedding. We shall not practice child marriage.

12. We shall not inflict any injustice on anyone, nor shall we allow anyone to do so.

13. We shall collectively undertake bigger investments for higher incomes.

14. We shall always be ready to help each other. If anyone is experiencing difficulty, we shall all help him or her.

15. If we come to know of any breach of discipline in any centre, we shall all go there and help restore discipline.

16. We shall take part in all social activities collectively.

More information can be found at www.grameen.com.

2.9.2 Branch Location Data: BRAC and Grameen Bank

We collected the branch location data of all operating branches of the three largest MFIs in Bangladesh for this disseration. The MFIs recorded the branch location data in terms of district, upazila and union. For Grameen Bank that was the lowest administration classification available for the address of the branches. From the given classification, we have derived the geo-coordinates of the branches for this dissertation. We could not find the geo-coordinates for 25 branches of Grameen Bank out of the 2546 branches. The unions of the missing branches were not recorded by Grameen Bank. Therefore, we could not find a link to locate the women living in the missing branch areas. Hence we dropped the branches from our analysis. Given that the percentage of missing branches is less that 1%, we expect the missing branches to not bias our results. For BRAC, the institution had the geo-coordinated address of all of its branches available. However, we use 2042 branches out of currently listed 2348 branches of BRAC as the insitution had merged/re-structured its branches. The 300 branches we exclude in this chapter were established in the 2000s which was after the respondents reached their school-going age.

In addition, the third largest MFI in Bangladesh, ASA started its microcredit operation in 1992. In 1992, ASA had 159 branches compared to 1078 branches of Grameen Bank. ASA gradually expanded their branches over the decades and experienced an exponential expansion in early 2000s. In 1999, ASA had around 700 branches compared to approximately 1750 branches in 2004 (ASA, 2014). We have excluded ASA from our analysis in this chapter and the last chapter of the dissertation as most ASA branches were established after the respondents had reached school-going age. Furthermore, according to the management of ASA, the institution did not have a well-recorded branch establishment and merger year recording system before 2000.

2.9.3 Results: Bonferroni Corrections

Table 2.12: **Years of Schooling: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	-0.9685*	-0.6168*	-0.1744	-0.2390
	(0.353)	(0.243)	(0.403)	(0.341)
h	0.847	1.400	1.441	1.441
Obs around cutoff	[2138, 2424]	[2138, 2424]	[1372, 1686]	[1372, 1686]
N	4562	4562	3058	3058
Access to Credit at Age 8	0.0495	-0.1318	-0.1283	-0.5082
	(0.263)	(0.227)	(0.333)	(0.309)
h	1.105	1.105	1.322	1.322
Obs around cutoff	[3009, 4215]	[3009, 4215]	[1849, 2837]	[1849, 2837]
N	7224	7224	4686	4686
Access to Credit at Age 12	0.3551	0.1265	0.0774	-0.2639
	(0.249)	(0.220)	(0.399)	(0.364)
h	1.001	1.001	0.858	0.858
Obs around cutoff	[3274, 5296]	[3274, 5296]	[2019, 3522]	[2019, 3522]
N	8570	8570	5541	5541
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of completed years of schooling for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons includes the brothers of the phase 1 respondents. The estimates in column (2) and (4) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values if less than 0.014 for daughters and 0.025 for sons.

Table 2.13: **Primary School Completion: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	-0.0673	-0.0135	-0.0199	-0.0065
	(0.042)	(0.035)	(0.054)	(0.048)
h	0.924	1.100	1.289	1.289
Obs around cutoff	[2138, 2424]	[2138, 2424]	[1372, 1686]	[1372, 1686]
N	4562	4562	3058	3058
Access to Credit at Age 8	-0.0080	-0.0083	-0.0234	-0.0328
	(0.033)	(0.029)	(0.043)	(0.041)
h	1.128	1.128	1.200	1.200
Obs around cutoff	[3009, 4215]	[3009, 4215]	[1849, 2837]	[1849, 2837]
N	7224	7224	4686	4686
Access to Credit at Age 12	0.0308	0.0197	0.0458	0.0212
	(0.032)	(0.029)	(0.043)	(0.041)
h	1.008	1.008	0.999	0.999
Obs around cutoff	[3274, 5296]	[3274, 5296]	[2019, 3522]	[2019, 3522]
N	8570	8570	5541	5541
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of primary school completion for for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons include the brothers of the phase 1 respondents. Primary school completion is taken as a binary indicator set to 1 if the children have completed 5 years of schooling or more and 0 otherwise. The estimates in column (2) and (4) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values if less than 0.014 for daughters and 0.025 for sons.

Table 2.14: **Secondary School Completion: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	-0.1000	-0.0935	-0.0471	-0.0575
	(0.050)	(0.041)	(0.044)	(0.039)
h	0.839	1.100	1.543	1.543
Obs around cutoff	[2138, 2424]	[2138, 2424]	[1372, 1686]	[1372, 1686]
N	4562	4562	3058	3058
Access to Credit at Age 8	0.0181	-0.0128	-0.0390	-0.0858
	(0.031)	(0.026)	(0.044)	(0.042)
h	1.092	1.092	0.959	0.959
Obs around cutoff	[3009, 4215]	[3009, 4215]	[1849, 2837]	[1849, 2837]
N	7224	7224	4686	4686
Access to Credit at Age 12	0.0244	0.0085	0.0137	-0.0204
	(0.028)	(0.026)	(0.040)	(0.039)
h	0.972	0.972	0.964	0.964
Obs around cutoff	[3274, 5296]	[3274, 5296]	[2019, 3522]	[2019, 3522]
N	8570	8570	5541	5541
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of secondary school completion for for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons include the brothers of the phase 1 respondents. Secondary school completion is taken as a binary indicator set to 1 if the children have completed 10 years of schooling or more and 0 otherwise. The estimates in column (2) and (4) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.15: **Age of Marriage: Daughters and Sons**

	Daughters		**Sons**	
	(1)	(2)	(3)	(4)
Access to Credit at Age 1	0.0178	-0.0310	0.2755	-0.4969
	(0.300)	(0.216)	(0.523)	(0.488)
h	1.079	1.800	0.835	0.835
Obs around cutoff	[1621, 1612]	[1621, 1612]	[536, 533]	[536, 533]
N	3233	3233	1069	1069
Access to Credit at Age 8	-1.1827*	-0.6736*	0.2431	0.2176
	(0.316)	(0.239)	(0.332)	(0.292)
h	0.684	0.900	1.339	1.339
Obs around cutoff	[2598,3168]	[2598,3168]	[1302, 1303]	[1302, 1303]
N	5766	5766	2605	2605
Access to Credit at Age 12	-0.7360*	-0.3661	-0.1724	-0.2265
	(0.257)	(0.217)	(0.338)	(0.295)
h	0.590	0.800	1.278	1.278
Obs around cutoff	[2926, 4147]	[2926, 4147]	[1352, 1740]	[1352, 1740]
N	7073	7073	3092	3092
Controls	No	Yes	No	Yes

Note: The table presents the local linear estimates of age at first marriage for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The sample of sons includes the brothers of the phase 1 respondents. The estimates in column (2) , and (4) include age, age-sq, religion, parental education, parental landholdings of children as controls. District of birth of children dummies are applied as controls in only column (2) for daughters but not in column (4) for sons due to no observations in some districts. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.16: **Marriage before 15: RD Results for Daughters**

	Daughters	
	(1)	(2)
Access to Credit at Age 1	0.0290	0.0585
	(0.043)	(0.034)
h	1.162	1.800
Obs around cutoff	[1621, 1612]	[1621, 1612]
N	3233	3233
Access to Credit at Age 8	0.0322	0.0556
	(0.035)	(0.035)
h	0.745	0.900
Obs around cutoff	[2598,3168]	[2598,3168]
N	5766	5766
Access to Credit at Age 12	0.0000	0.0064
	(0.030)	(0.029)
h	0.953	0.953
Obs around cutoff	[2926, 4147]	[2926, 4147]
N	7073	7073
Controls	No	Yes

Note: The table presents the local linear estimates of incidence of marriage before the age of 15 for daughters and sons. The sample of daughters includes sample of phase 1 respondents and their sisters. The outcome variable is taken as a binary indicator set to 1 if the daughters have married before the age of 15 and 0 otherwise. We report the estimates for daughters only as very few men were married by the age of 15. The estimates in column (2) include age, age-sq, religion, parental education, parental landholdings of daughters as controls. District of birth fixed-effects are applied in column (2). h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values if less than 0.014 for daughters.

Table 2.17: **Marriage before 18: RD Results for Daughters**

	Daughters	
	(1)	(2)
Access to Credit at Age 1	-0.0057	-0.0597
	(0.060)	(0.043)
h	1.057	1.800
Obs around cutoff	[1621, 1612]	[1621, 1612]
N	3233	3233
Access to Credit at Age 8	0.1395*	0.0882*
	(0.052)	(0.043)
h	0.574	0.900
Obs around cutoff	[2598,3168]	[2598,3168]
N	5766	5766
Access to Credit at Age 12	0.1002	0.0434
	(0.045)	(0.043)
h	0.579	0.579
Obs around cutoff	[2926, 4147]	[2926, 4147]
N	7073	7073
Controls	No	Yes

Note: The table presents the local linear estimates of incidence of marriage before the age of 18 for for daughters. The sample of daughters includes sample of phase 1 respondents and their sisters. The outcome variable is taken as a binary indicator set to 1 if the daughters have married before the age of 18 and 0 otherwise. We report the estimates for daughters only as very few men were married by the age of 18. The estimates in column (2) include age, age-sq, religion, parental education, parental landholdings of daughters as controls. District of birth fixed-effects are applied in column (2). h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected robust p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.18: **Incidence of Dowry: RD Results for Respondents**

	1	2
Access to Credit at Age 1	0.0282	0.0335
	(0.082)	(0.065)
h	1.260	1.270
Obs around cutoff	[881, 811]	[881, 811]
N	1692	1692
Access to Credit at Age 8	0.0175	-0.0029
	(0.059)	(0.052)
h	1.138	1.138
Obs around cutoff	[1535,1691]	[1535,1691]
N	3226	3226
Access to Credit at Age 12	-0.0695	-0.0739
	(0.054)	(0.051)
h	0.984	0.984
Obs around cutoff	[1683, 2244]	[1683, 2244]
N	3927	3927
Controls	No	Yes

Note: The table presents the local linear estimates of incidence of dowry for respondents. The sample of respondents includes the sample of phase 1 respondents and the sample of phase 2 respondents. The outcome variable is taken as a binary indicator set to 1 if there was incidence of any pre-marital cash or in-kind tranfer and 0 otherwise. The estimates in column (2) include age, age-sq, age of menarche, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values if less than 0.025 for respondents.

Table 2.19: **Husband Characteristics: RD Results for Respondents**

	Education		Parental Landholdings		Occupation	
	(1)	(2)	(3)	(4)	(5)	(6)
Access to Credit at Age 1	-1.0724	-1.3017	-38.4780	-25.4460	0.1104	0.0963
	(0.641)	(0.512)	(50.692)	(39.179)	(0.061)	(0.120)
h	1.159	1.200	1.050	1.100	1.099	1.099
Obs around cutoff	[880, 807]	[880, 807]	[880, 807]	[880, 807]	[967, 912]	[967, 912]
N	1687	1687	1687	1687	1879	1879
Access to Credit at Age 8	-0.4956	-0.9131*	-5.6448	-11.3820	0.0521	0.0715
	(0.469)	(0.401)	(27.742)	(24.248)	(0.048)	(0.044)
h	1.265	1.265	1.204	1.204	1.047	1.047
Obs around cutoff	[1532, 1685]	[1532, 1685]	[1532, 1685]	[1532, 1685]	[1624, 1829]	[1624, 1829]
N	3217	3217	3217	3217	3453	3453
Access to Credit at Age 12	-0.3301	-0.4581	4.8058	5.7878	0.0264	0.0404
	(0.505)	(0.423)	(21.947)	(19.141)	(0.036)	(0.033)
h	0.821	0.821	1.093	1.093	1.385	1.385
Obs around cutoff	[1688, 2239]	[1688, 2239]	[1688, 2239]	[1688, 2239]	[1763, 2410]	[1763, 2410]
N	3927	3927	3927	3927	4173	4173
Controls	No	Yes	No	Yes	No	Yes

Note: The table presents the local linear estimates of characteristics of marriage partners for respondents. The sample of respondents includes the sample of phase 1 respondents and the sample of phase 2 respondents. The outcome variables in columns (1) and (2) are completed years of schooling of husbands. Columns (3) and (4) have parental landholdings (in hectares) of the groom at the time of marriage of the respondents as outcome variables. Columns (5) and (6) have binary indicators of occupation choice of grooms of respondents at the time of marriage as the outcome variables. The binary indicator denotes if the groom is in a low-pay occupation. The estimates in column (2), (4) and (6) include age, age-sq, age of menarche, religion, parental education, parental landholdings of respondents and district of birth dummies of respondents as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches. Statistical significance is denoted by bonferroni corrected p-values if less than 0.025 for respondents.

Table 2.20: **Economic Participation Choice: RD Results for Daughters**

	Daughters	
	(1)	(2)
Access to Credit at Age 1	0.0043	-0.0070
	(0.042)	(0.039)
h	1.173	1.173
Obs around cutoff	[2138, 2424]	[2138, 2424]
N	4562	4562
Access to Credit at Age 8	0.0383	0.0447
	(0.036)	(0.034)
h	0.992	0.992
Obs around cutoff	[3009, 4215]	[3009, 4215]
N	7224	7224
Access to Credit at Age 12	-0.0191	0.0006
	(0.033)	(0.032)
h	1.047	1.047
Obs around cutoff	[3274, 5296]	[3274, 5296]
N	8570	8570
Controls	No	Yes

Note: The table presents the local linear estimates of employment choice of daughters. The daughters are grouped as respondents and their sisters pooled together. The outcome variable is taken as a binary indicator set to 1 if the daughter is involved in income-generating activity and 0 otherwise. Income generating activities include any form of economic activitiy in which she is control of the income. The estimates in column (2) include age, age-sq, religion, parental education, parental landholdings and district of birth of children dummies as controls. h is the bandwidth taken around the cut-off for estimation. Standard errors given in parantheses. Number of obs vary across the age variations in the tableas the age variations adjust the sample according to the year of birth of children and establishment year of the MFI branches.Statistical significance is denoted by bonferroni corrected p-values if less than 0.014 for respondents.

Chapter 3

Are Two Sources of Credit better than One?: Credit Access and Debt among Microfinance Clients in Bangladesh

3.1 Introduction

Microcredit was introduced in the mid-1970s with the goal of financial inclusion of the poor. It was considered to be the stepping-stone of bringing the poor out of poverty by giving them access to formal financial services. During the late 1990s, the industry experienced a rapid growth reaching approximately 200 million clients with 3000 microfinance institutions (MFIs) worldwide (MIX, 2014). There are more than 10,000 MFIs in the world (Forbes, 2007). This unprecendented growth of the microfinance industry led to a sharp increase in competition among microfinance institutions (Hermes and Lensink, 2007). Competition among the MFIs has driven down the interest rates in some microfinance sectors and has also given the clients a wider choice of services (McIntos and Wydick, 2005). However, researchers have argued that availability of multiple sources of credit has tempted clients to take more than one loan simultaneously (McIntosh and Wydick, 2005; Mpogole et al, 2012). Increased competition among MFIs for clients has led to a decline in the average quality of borrowers (Khandker, Khalily and Samad, 2016). In addition, the literature documents an increase in the practice of borrowing simultaenously from multiple MFIs and defaulting on MFI loans (Chen, Rasmussen and Reille, 2010; Guha and Chowdhury, 2013).

These trends have led to a growing discussion about the risk of multiple borrowing and delinquency among microcredit clients in developing countries due to increased availability of credit (Taylor, 2011; Guerin et al, 2011; Kappel et al, 2010). The recent collapse of the microfinance sectors in Andhra Pradesh (India), Morocco, Philippines, Nicaragua and some parts of Bolivia has made multiple borrowing more of a growing concern for the microfinance industry and development practitioners (Gonzalez, 2008; Mader, 2013).

In this chapter, we aim to empirically investigate whether access to multiple sources of MFI loans has an impact on borrowing among microfinance clients in Bangladesh. Furthermore, we examine if it subsequently leads to an effect on psychosocial wellbeing of the microfinance borrowers. MFIs in Bangladesh follow an exogenous operational rule, as explained in chapter 1, of covering a certain radius to seek and serve borrowers. This operational rule creates a discontinuity in credit access, and provides the basis for our identification strategy. We use this quasi-experimental set up to estimate the impact of multiple sources of to credit using a regression discontinuity design (RDD). To study the impact of an additional source of credit, we compare individuals with access to two sources of credit – i.e. those located within the operating zones of 2 MFI branches – with individuals with access to a single source of credit. Using the geo-referenced location of all branches of the three largest MFIs in Bangladesh – ASA, BRAC and Grameen Bank –combined with a nationally representative household survey of women in Bangladesh, we investigate impact of multiple sources of credit on borrowing and income and subsequent impact of borrowing on psychosocial wellbeing of the borrowers.

The borrower outcomes in our study are: i) outstanding debt (amount and number of outstanding loans) and ii) delinquent debt (amount and number of delinquent loans). Outstanding debt is measured as total debt which the borrowers had not repaid in full at the time of the survey. Delinquent debt is measured as total debt that a borrower had failed to repay within the period of the repayment schedule. We also examine monthly income of the respondents. The psycho-social wellbeing outcomes used in this study are self-reported measures of overall happiness, life satisfaction, financial satisfaction and health satisfaction.

In our analysis, we find that access to an additional source of credit leads to a reduction of a borrower's outstanding debt. Amount of outstanding loans decline by USD 44.75 (which is around BDT 3470)[1] and number of outstanding loans decline by 0.07. However, we do not see any effect of an additional source of credit on delinquent debt. We also do not see an effect of a second MFI branch on monthly income of borrowers. In addition, we find no impact of outstanding debt on psycho-social wellbeing of borrowers.

The findings of this study are particularly interesting as according to standard economic theory an additional MFI branch should have no effect on borrowing. Our findings align with the existing literature suggesting that, due to information asymmetry among MFIs, clients borrow from multiple sources for two reasons: (i) to accumulate the desired amount of credit as MFIs practise credit rationing and, (ii) repay existing loans (Mpogole et al., 2012; Karim, 2011; Krishnaswamy, 2007). However, our results imply that expansion of credit access leading to multiple borrowing does not necessarily push borrowers towards over-indebtedness, as anticipated by policymakers. We see no effect of an additional source of credit on monthly income of borrowers. Furthermore, our results on impact of outstanding debt on psychosocial wellbeing imply that increased debt does not affect borrower welfare. Our results corroborate with the results of Angelucci, Karlan and Zinman (2013) finding no effect of group loans on life satisfaction and economic status of microcredit clients.[2] Therefore, we provide evidence that increased access to credit does not result in over-indebtedness. On the contrary, it reduces debt of borrowers. In addition, an increased debt has no effect on wellbeing of clients.

The remainder of the chapter is organised as follows. Section 2 discusses the related literature. Section 3 describes the microfinance sector of Bangladesh. The data used in the analysis is discussed in section 4 and section 5 sets out the identification strategy. The results are reported in section 6 and discussed in section 7.

[1] 1 USD= 77.55 BDT (Bangladeshi Taka) according to the exchange rate in 2014.

[2] However, the authors studied the impact of loans (not outstanding debt) on borrower welfare. They also found an increase in happiness and trust in others among borrowers which could due to high frequency of group meetings.

3.2 Related Literature

There is a growing literature on multiple borrowing and indebtedness in the microfinance sector. Anecdotal evidence from different developing countries such as Philippines, Nicaragua and Morocco suggests that microfinance clients are often over-indebted (CGAP, 2012). The authors measure over-indebtedness as the scenario when the borrowers struggle to meet the repayment of their existing loan. According to the qualitative study, the borrowers often take up multiple loans to smooth out repayment schedule. Independent household surveys carried out in Kenya, Sri Lanka and Bangladesh revealed that over 70% of the respondents who were consistent microfinance clients in all three countries had problems in loan repayment because of multiple pending loans (Boiwa and Bwisa, 2014; Ravichandran, 2016; Afroze et al, 2014). Boiwa and Bwisa (2014) using a descriptive research design found a strong correlation between borrower's characterisitics, such as education and household size, with multiple borrowing among a small group of borrowers in Kenya. The authors used detailed qualitative interviews and document analysis of 8 groups of microfincance clients to present their findings. Afroze et al. (2014), using interviews of a sample of borrower in Bangladesh, found that 71% of the survey respondents reported to have multiple loans. Furthermore, 69% of the respondents reported having delinquent loans. The study showed that borrowers with multiple loans had repayment problems compared to borrowers with a single loan.

As an alternative approach, Schicks (2013) proposed to measure over-indebtedness among borrowers by using 'sacrifices' borrowers make to meet their repayment obligations. The study estimated that about 30 percent of urban microcredit clients in Ghana are over-indebted and subsequently make heavy sacrifices, in terms lower consumption, to repay their loans. The author suggested that over-indebtedness has the potential to push borrowers further into poverty, accompanied by the material, psychological and sociological consequences of debt. Although the studies mentioned above qualitatively examine the impact of over-indebtedness on wellbeing of borrowers, the literature does not provide a consistent and quantitative method to estimate multiple borrowing and a measure over-indebtedness.

Khandker and Samad (2014), using longitudinal data for 20 years in Bangladesh, found that multiple borrowing raises borrower's assets and net worth rather than create indebtedness. Using the same data in another study, Khandker and Samad

(2013) defined over-indebtedness as a debt liability-to-asset ratio of 40% or more, and found a quarter of microcredit clients in Bangladesh to be over-indebted. However, the authors found that access to microcredit lowered the probability of borrowers of being over-indebted. The borrowers accumulated larger assets than debt. Thus, access to microcredit led to a decline in debt liability-to-asset ratio. Krishnaswamy (2007) using a panel data of 500,000 clients in villages in India compared multiple borrowing to single borrowing. The study found 11% of the sample to have multiple loans. They found that multiple loans led to equal or better repayment records than single source borrowing. This is partly because 75% of the clients took up multiple loans to repay existing loans. Chaudhary and Matin (2002) carried out a survey of a sample of borrowers of BRAC in Bangladesh to study multiple borrowing. The study found that households borrowed from multiple sources due to urgent need for a large sum of money. Although the borrowers were found to be irregular in their repayment, they did not default in the long run. The literature reviewed above study multiple borrowing in different countries, the studies do not provide causally estimated evidence on impact of multiple borrowing or multiple sources of credit on borrowers.

While microfinance provides credit access to the poor to improve their economic outcomes, recent studies argue that the stringent repayment schedule of microcredit contracts increase financial stress of the borrowers. Field et al. (2012) conducted a field experiment in India to examine the impact of repayment flexibility on self-reported financial stress. The experiment randomly assigned borrowers in either a monthly repayment schedule or the more common weekly-repayment schedule. Availability of credit and terms of contract, other than the repayment schedule, were identical to a standard loan contract. The study found that borrowers on the monthly repayment schedule were 51% less likely to be distressed about repayments. In addition, these borrowers had invested the loans in more profitable opportunities, which in effect had resulted in higher household income. This subsequently led to lower psychological cost of indebtedness.

In addition, Angelucci, Karlan and Zinman (2013) in their randomized trial in Mexico estimate the impact of group-liability loans on borrower welfare. The study found that group loans increased happiness among clients by 0.045 standard deviations and trust in people by 0.05 standard deviation. This could be an effect of the setting of group contracts where clients are required to meet frequently. In addition, the study found 1 percentage point increase in likelihood of borrowers to report being better physical health. However, the authors found no effect of credit on life satisfaction, economic status or job stress.

This chapter adds to the literature by causally estimating the impact of an additional source of credit on borrowers in terms of outstanding debt, delinquent debt and monthly income. In addition, it investigates the impact of outstanding debt on psychosocial wellbeing among borrowers to tap if outstanding debt causes distress to borrowers. To the best of our knowledge, the chapter is the first study to do so.

The next section discusses the microfinance sector of Bangladesh.

3.3 Background

Microfinance was introduced in Bangladesh in mid-1970s to combat rural poverty through access to credit. The sector has experienced a phenomenal growth, at a rate of around 15% per annum, since the mid-1990s when microfinance was announced as the primary tool for the goal of poverty alleviation in the Millenium Development Goals (CGAP, 2002). The total population of households in Bangladesh that have borrowed from MFIs is nearly 40 million (BRAC, 2019; MIX, 2013, Institute of Microfinance Annual Report, 2009). There are over a thousand microfinance institutions with a network of over 17 thousand branches across Bangladesh making it an almost saturated market (Rahman, 1999; Microfinance Regulatory Authority, 2014).

The high growth rate coupled with commercialization of the MFIs in the early 2000s increased competition among the institutions for a higher market share (Khandker, Khalily and Samad, 2016). By 2008, around 27 million borrowers had memberships of multiple MFIs often with multiple loans in 2008 (Institute of Microfinance Annual Report, 2009). Khalily and Farid (2011) estimated a 15% growth rate of overlapping loans in Bangladesh.[3] This led the government to create a regulatory agency, Microcredit Regulatory Authority (MRA), to monitor MFI outreach, policies and activities. MRA introduced an interest rate ceiling for loans for all MFIs. The increased competition among the MFIs and the interest rate ceiling of MRA subsequently led to a nearly perfectly competitive market in Bangladesh where the

[3]Chaudhary and Matin (2002), studying a sample of borrowers of BRAC with multiple MFI memberships, found that households borrowed from multiple NGOs. However, they had only one loan from each MFI.

MFIs offer very similar loan contracts often with the same grace period, interest rates and repayment schedule [4].

The microfinance sector in Bangladesh is dominated by the three largest MFIs: ASA, BRAC and Grameen Bank. They account for about 62% of all microfinance borrower accounts and approximately 69% of the sector's gross loan portfolio (Khalily et al, 2014; Microfinance Regulation Authority, 2014). These 3 MFIs had doubled their market penetration since the 2000s setting out a total of around 9000 branches. This resulted in most regions being served by multiple MFIs or multiple branches of the same MFIs (Institute of Microfinance, 2009). At the end of 2008, these institutions were responsible for around 23 million borrowers with outstanding loans of BDT[5] 126 million out of total of BDT 159 million of outstanding loans for the entire microfinance sector (Insitute of Microfinance Annual Report, 2009; Credit Development Forum, 2009).

Competition among the MFIs has had negative consequences on the microfinance sector in Bangladesh. Relative to commercial banks, microfinance institutions had a practice of investing a significant amount of time with the clients. This seemed to be an essential component for risk minimization especially in the absence of a central credit bureau. Increased competition among the MFIs through exponential expansion of branches has led to larger portfolios for the MFIs. As a result, MFIs often do not have the information whether clients have any other outstanding loan (in some cases, even if it is from a different branch of the same MFI) (Matin, 1997; Chaudhury and Matin, 2002). This led to a substantial increase in information asymmetry and higher credit risk (FinDev Gateway, 2011).

McIntos and Wydick (2005) found that competition among the MFIs reduced the interest rates for some borrowers in Bangladesh. However, the study also found that 32% of Grameen Bank's loan portfolio in northern Bangladesh was overdue by 2 or more years. CGAP (2011) suggests that rapid growth of MFIs or even an individual MFI branch expansion has the potential to saturate the market. This could lead to loan portfolio problem, as observed by McIntos and Wydick (2015), often overlooking the impact on the borrowers.

[4] A detailed description of loan terms is attached in the Appendix**

[5] Bangladeshi Taka

The next section provides the conceptual framework where the mechanisms through which multiple sources of credit can have an effect on borrowing are discussed.

3.4 Conceptual Framework

According to standard neo-classical theory of perfect knowledge and competition, an additional source of credit should not have an effect on borrowing. This is because of the assumption of perfect information between the MFIs and the borrowers, particularly in presence of strong competition. It is more so because, as mentioned in the previous section, Bangladesh has a nearly perfectly competitive microfinance sector in terms of loan contract terms, repayment schedule, interest rates and default penalty schemes. However, in the market when information asymmetry exists this hypothesis would change.

A number of studies provides evidence that asymmetric information increases in presence of stiff competition among the MFIs. Increase in number of lenders increases competition and in such cases, MFIs compete over market share of borrowers and refrain from sharing borrower information with other MFIs. This happens more in a saturated market as information on borrowers is diluted across a larger group of lenders (Hoff and Stiglitz, 1998; McIntosh and Wydick, 2005; Gonzalez, 2008; Karim, 2011; Khandker, Khalily and Samad, 2016). However, the literature diverges in the findings of increased competition. McIntosh and Wydick (2005) found that competition only helps the better-off borrowers as they can attain larger loans. On the other hand, Zeller and Meyer (2002) finds that in presence of strong competition, MFIs avoid ultra-poor borrowers due to higher monitoring costs of the poor borrowers and potential adverse selection problem. This leads to mission drift among MFIs contradicting the goal of the program (Copestake, 2007). Furthermore, information asymmetry also leads to poor borrowers taking up multiple loans to acculumate large sum of loasn. This is because of two reasons: (i) borrowers, often struggling with poverty, have high demand for credit and (ii) information asymmetry helps the borrowers to obtain larger sum of loans by borrowing from multiple sources. This creates overlapping debt problems for borrowers.

CGAP (2011) suggests rapid expansion of microcredit, leading to market saturation, is early indication of over-indebtedness. The authors define over-indebtedness to be the scenario when the borrowers face serious problems in repaying their loans. It also implies that borrowers can be over-indebted even if they manage to repay loans. Recent microfinance literature also argues that borrowers often have present-biased preferences (Laibson, 1997; Fudenberg and Levine, 2006) and they consistently make choices that are detrimental to their own well-being (Barr, Mullainathan and Shafir, 2008; Mullainathan and Krishnan, 2008). Irrationality of borrowers might trigger overlapping debt problems among the borrowers but it is not necessarily the only reason of multiple borrowing. The irrational borrowing behavior can also be generalized over the commercial credit market serving the richer population leading to an increase in over-indebtedness. However, it hurts the poor more due to their vulnerability to income shocks and coping mechanisms undertaken during the income shocks (Banerjee and Duflo, 2007).[6]

On the other hand, Khandker, Khalily and Samad (2016) using Credit Development Forum surveys in Bangladesh finds evidence that presence of multiple MFIs and increased borrowing has positive impact on women in terms of higher household income, higher investments in agricultural activities and better loan recovery rates. Given the existing evidence, we hypothesize in our analysis that, according to standard economic theory, multiple sources of credit should not affect borrowing levels for rational borrowers. Our hypothesis relies on the fact that MFIs, particularly the three considered in this study, offer standard microcredit contracts across the institutions. Therefore, the loan contracts and repayment schedule is assumed to be similar, if not identical.[7] Furthermore, in our study, an additional source of credit is considered to be a branch of another MFI or a branch of the same MFI. Borrowers, if needed, could borrow additional loans, either in amount or number, from the first source of credit they have access to. Hence the theoretical hypothesis of this study is that a second MFI branch would not affect borrowing outcomes.

There is another strand of literature on effects of increased borrowing and effects on psychological health of borrowers. CGAP (2011) suggests that multiple borrowing leads to over-indebtedness. It might increase vulnerability and further

[6]There is a well-developed literature on credit card borrowing and debt trap among the rich (Stango and Zinman, 2009; Lusardi, Schneider and Tufano, 2011; Amar et al., 2011).

[7]MFIs offer differentiated services, such as micro-savings, across the institutions but the microcredit programmes are often the replication of the Grameen Bank model, at least for the 3 largest MFIs.

impoverishment of borrowers. This could happen through multiple channels such as lower consumption and downward spiral of ever-increasing debt. Shicks (2013) uses a subjective measure of borrower sacrifices to examine costs of over-indebtedness. The author suggests that 30% of microfinance clients in Ghana are over-indebted and as a result are severely distressed. The borrowers had to make costly sacrifices, such as skipping meals, to meet their loan repayment obligations. Thus, we hypothesize in our study that increased borrowing, if any, due to additional source of credit would lead to a negative effect on the pyscho-social indicators of the women.

The next section describes the data used in the analysis of the study.

3.5 Data

The empirical analysis of this paper uses two different datasets: the 2014 Women's Life Choices and Attitudes Survey (WiLCAS) and geo-referenced branch record of the three largest microfinance institutions in Bangladesh. The 2014 WiLCAS is a nationally representative survey of women in Bangladesh between the ages of 20 and 39. Asadullah and Wahhaj (2018) conducted the household survey for a project funded by Australian AID.[8] We use this survey in our analysis as it includes geo-referenced current location of women and detailed record of their microfinance borrowing. The 2014 WiLCAS was conducted in two phases. The sample of the first phase of the survey was selected from the 2010 Bangladesh Household Income and Expenditure Survey (HIES) and includes all rural households in HIES with one or more female household members. In addition, a random sample of 1,500 sisters of the 6,293 women in the phase 1 sample were tracked and interviewed for a second phase of the survey. We use both phases of the survey giving us a total sample of 7,771 women.

It consists of individual interviews of adult women which include information on their background such as age, current residence, educational attainment and employment status. In addition, it has detailed record of microcredit borrowing of the women where they report their membership of MFIs, list of loans taken from the MFIs with respective years and whether they had repaid the loans at the time of the survey. Furthermore, the survey has information on the parental characteristics of the women such as parental education and landholdings. The survey also includes a

[8] More details about the survey can be obtained from the website www.integgra.org

module where the women were asked about their psychosocial wellbeing factors such as life satisfaction, health satisfaction, financial satisfaction and overall happiness.[9]

From the survey, we observe the sources women borrow from. Table 3.1 reports their borrowing composition. 28.53% of the loans taken by the women were from Grameen Bank, 25.95% from ASA and 13.84% from BRAC. Only 3.46% of loans taken by the women were from other MFIs. Commercial bank loans accounted for only 0.70% of the loans. The remaining 26% of the loans where borrowed from informal sources such as family, friends, local usurers and mutual funds. Therefore, for our analysis we focus on the three MFIs which account for approximately 70% of the MFI loans: ASA, BRAC and Grameen Bank. Henceforth, all borrowing outcomes mentioned in the study represent loans taken from only these three MFIs in Bangladesh. The informal sources are available both in control and treatment areas which is why it does not affect our analysis. Approximately 87% of the respondents have access to multiple sources of credit and around 27% of these respondents reported to have borrowed from multiple sources, even if not simultaneously.

In order to determine each respondent's access to credit, we collected the geo-referenced branch location data at the union[10] level of all operating branches of each of these three MFIs across Bangladesh. We retrieved 2,886 branch locations of ASA, 2,364 branch locations of BRAC and 2,555 branch locations of Grameen Bank.[11] To identify the women's location, we use the geo-referenced location of residence at the village level of each respondent of the survey. We spatially map the geo-referenced location of the MFIs at the union level with the geo-referenced location of the respondents at the village level to calculate the distance of each branch of the MFIs from the respective villages of women. We calculate the number of MFI branches each respondent has access to in order to study the impact of access to an additional MFI branch. This will be discussed in detail in the next section.

[9] See Section 3.9.1 in the Appendix for further details about the indicators on psychosocial wellbeing.

[10] A union is the smallest rural administrative and local government unit in Bangladesh.

[11] See Appendix 3.9.2 for further details about the branch location data.

3.5.1 Descriptive Statistics

Table 3.2 provides the descriptive statistics for the survey respondents. The mean age of the women is 29 years with a standard deviation of around 6 years. Average parental landholdings is 1.39 acres of land. The average monthly income of the sample is BDT 12,219 which is roughly around USD 157.56.[12] The survey has information on the loans that the women have taken and had not repaid at the time of the survey. All loans which were not repaid in full at the time of the survey are referred to as outstanding loans. The average amount of outstanding loans is BDT 4,279.91 and the average number of outstanding loans per respondent is 0.20. Loans which were defaulted for over a year are referred to as delinquent loans. The average amount of delinquent loans was BDT 997.46 and the average number of delinquent loans per respondent was 0.08. Given the few observations for delinquent loans, it could be possible that respondents have not reported their delinquent loans but intuitively it does not seem to be an issue. This is because the information was not collected by a MFI or any credit bureau. We focus more on outstanding debt in this chapter and delinquent debt gives us a comprehensive insight. The survey follows the "Cantril's Ladder of Life Scale", as proposed by George (1981) and Ravallion and Lokshin (1999), for the happiness and satisfaction questions where the respondents are shown a ladder with steps numbered from 1 to 10 to demonstrate their satisfaction level. In the scale, 1 represents 'not happy at all' and 10 respresents 'extremely happy'. The mean for each of the four psycho-social wellbeing questions is approximately 5 with a standard deviation of around 2.

3.6 Identification Strategy

While access to credit has been widely studied, it is not often measured in terms of bank branches due to the common endogeneity factors (Burgess and Pande, 2005). The identification concern is also valid for microfinance branch access. This is because MFIs like commercial banks select their operational regions taking into account the population density, geographical feasibility, demand of microfinance and other operational factors making it difficult to determine control and treatment groups. In this chapter (similar to the second chapter), we address the concern by using regression discontinuity design through the exogenous operational rule of MFIs. A

[12] The exchange rate is taken for 2014 at 1 USD =77.55 BDT.

few studies have used regression discontinuity design to study the impact of microfinance in Bangladesh using an eligibility based on borrower's landholdings (Pitt and Khandker,1998 (as reviewed in the second chapter); Morduch, 1998; Morduch and Roodman, 2005; Akhtaruzzaman and Farooq, 2016).

This study contributes to the literature by using a spatial regression discontinuity design where the discontinuity in treatment assignment is geographic to measure access to an additional source of credit. In this setup a geographic boundary splits households into treatment and control groups. MFIs in Bangladesh work within a certain radius to seek and serve borrowers. We take advantage of this exogeneous rule of operation of MFIs to act as a cut-off for the forcing variable in our empirical analysis to classify control and treatment groups. MFIs in Bangladesh have varying thresholds to determine servicing area. Grameen Bank and BRAC cover a radius of 4 kilometer of distance to give out loans to borrowers and ASA covers a radius of 5 kilometers to do so.

In order to measure access to multiple branches of credit, the control group is taken to be the households of respondents who have access to just one branch of a MFI, i.e. the respondents are located within the operational area of one MFI branch, and the treatment group is taken to be the households who have access to two branches, i.e. the respondents are located within the operational area of two MFI branches. We construct the running variable of access to credit by mapping the geo-referenced locations of all the operating branches of these MFIs across Bangladesh and the location of the respondents to calculate the minimum distance of each respondent to each of the branches of the MFIs. Following this, we derive the number of MFI branches each respondent has access to and form the control and treatment groups accordingly. The respondents who are located within the operational area of only one MFI branch form our control group and the respondents who are located within the operational area of 2 MFI branches form our treatment group. In this study, we include only the respondents with access to either one or two MFI branches and exclude the respondents with no credit access or access to more than 2 MFI branches. This allows us to tap the effect of an additional branch of credit on respondents after their first branch access. To the best of our knowledge, this study is the first to use spatial discontinuity as the running variable to examine the impact of multiple sources of microcredit in Bangladesh.

Mathematically, the running variable is given by the following formula:

$$R^i_{1,2} = min_{b \neq b^i_{0,1}}(C_{o(b)} - d_{ib}) \tag{3.1}$$

$$b^i_{0,1} = argmin_b(C_{o(b)} - d_{ib}) \tag{3.2}$$

where $R_{1,2}$ denotes the running variable for the respondents who are the borrowers, the subscript $1, 2$ of $R_{1,2}$ shows that the control group has access to 1 MFI branch and the treatment group has access to 2 MFI branches, index i denotes the borrower and index b denotes the MFI branch, $o(b) \in$ indicates the organisation to which branch b belongs, either ASA, BRAC or Grameen Bank, d_{ib}= distance of household of the borrower i from branch b, and $C_{o(b)}$= distance threshold of the MFIs (4 km for BRAC and Grameen Bank; 5 km for ASA).

As demonstrated by the formula, the running variable is centered at the threshold. For ease of interpretation, the running variable is such that a negative value in the x-axis of all the plots means that the individual would have to travel some distance to be within the catchment area of the second closest branch; while a positive value means that the individual is already within the catchment area of the second closest branch. In both cases, the magnitude of the value is the distance of the respondent from the boundary of the catchment area of the second-closest MFI branch.

To estimate the impact of multiple sources of credit on loans, we employ a non-parametric local polynomial method using a fuzzy regression discontinuity design where the first stage represents the impact of access to credit on debt and monthly income. The first stage allows us to examine if an additional source of credit has an impact on outstanding debt and monthly income. Following this in the second stage, we estimate the impact of the outstanding debt on psycho-social wellbeing indicators of the borrowers.[13] We use a fuzzy regression discontinuity approach as we aim to investigate the impact of the outstanding debt on psychosocial wellbeing instrumented through the running variable of access to credit. Empirically we estimate the following equations:

$$First\ Stage : Y_i = \alpha + \tau D_i + \beta R^i_{1,2} + \delta X_i + u_i \tag{3.3}$$

$$Second\ Stage : PsychosocialWellbeing_i = \nu + \eta Debt_i + \gamma R^i_{1,2} + \lambda X_i + \epsilon_i \tag{3.4}$$

[13]In this study, we use the RD estimation package 'rdrobust' following Cattaneo et al (2017) which gives us bias corrected RD estimates using data-driven optimal bandwidth.

where Y_i denotes the borrowing outcomes of interest for each borrower such as, i) outstanding debt (amount and number of outstanding loans) and ii) delinquent debt (amount and number of delinquent loans), and monthly income for each borrower for the first stage. For the second stage equation, $PsychosocialWellbeing_i$ represents the outcome of interest, such as the four psychosocial wellbeing indicators: overall happiness, life satisfaction, financial satisfaction and health satisfaction. $D_i \in \{0, 1\}$ indicates access to multiple sources of credit such that $D_i = 1$ if $R^i_{1,2} > 0$ and D $= 0$ if $R^i_{1,2} < 0$. τ is the coefficient of interest for borrowing and income outcomes measuring the effect of the discontinuity at the cut-off representing the local average treatment effect. X_i is a set of covariates of borrowers including age, age-squared, parental education and parental landholdings and u_i and ϵ_i are the idiosyncratic errors.

Local linear regression is the most common form of nonparametric method in the RDD literature. This is because the non-parametric estimation is based on the observations closer to the cut-off, making it intuitively appealing as the observations are valid counterfactuals of each other. This reduces some bias that can result from using data farther away from the cutoff to estimate the discontinuity at the cutoff. The continuity around the threshold provides evidence of internal validility of the setup.

Before presenting our main estimation results, we check for manipulation of the running variable, i.e., self-selection into the treatment to see if the women have chosen to live in the areas where they would have access to multiple sources of credit. We do this by checking the density of households of respondents around the threshold. A discontinuity at the threshold of the running variable (with higher density in the treatment group) would indicate that the respondents have self-selected themselves into the treatment group. Figure 3.1 shows the plot for the McCrary density test of manipulation of the running variable for access to credit of respondents (McCrary, 2008). Figure 3.2 shows the plots for the McCrary test for the sample of Phase 1 and Phase 2 separately. The sample of Phase 1 includes a sample of respondents selected from the 2010 HIES and the sample of Phase 2 includes 1,500 sisters of the Phase 1 respondents randomly chosen to survey. The plots are continuous around the threshold. This provides evidence of internal validity of the emprical strategy showing that there was no sorting around the threshold of access to credit.

As robustness checks, we estimate our first equation with six pre-determined characteristics to test for discontinuity as proposed by Lee (2008) and Lee and Lemieux (2010). The pre-determined characteristics of the respondents that we test for discontinuity are age, education, mother's education, father's education, parental landholdings and religion. We check age and education for a discontinuity at the threshold as other studies have shown that these characteristics are correlated with multiple borrowing (Boiwa and Bwisa, 2014). In addition, we test parental landholdings for a discontinuity as landholdings (half an acre of land) is another eligibility criteria of the microfinance program and has been used as a forcing variable for a microfinance impact study (Pitt and Khandker, 1998). We also test parental characteristics for discontinuities as there is extensive evidence of parental education influencing social outcomes of children (Chevalier, 2004; Ermisch and Pronzato, 2010).

As proposed by Calonico (2015), we use a data-driven sequence to select number of bins for all plots. This method ensures that the plots represent the discontinuity taking into consideration the variability of data. The dots in the plots represent binned sample means of the outcomes of interest using the fourth polynomial and uniform kernel. The x-axis represents the running variable of access to two sources of credit for a range of 8 kilometers with 4 kilometers on each side of the threshold. A negative value indicates that the household is located outside of the catchment area of the second closest branch, while a positive value indicates that the household is located with the catchment area. In both areas, the magnitude of the variable represents the distance to the boundary of the catchment area. Figure 3.3 shows the series of plots of the pre-determined characteristics for a graphical analysis of the estimation. Other than the respondent's mother's education, we do not find evidence of discontinuity at the threshold for any of the pre-determined characteristics.

Table 3.3 shows the estimation results for pre-determined characteristics. We observe a positive discontinuity for religion only. We use a binary indicator for religion where the variable takes the value of 1 if the respondents are muslim and 0 otherwise. Therefore, a positive discontinuity means that respondents are 8.44 percentage points more likely to be muslim in the treatment. However, as we do not find any discontinuity for any other pre-determined characteristics, it is unlikely to affect our estimation. Nonetheless, we use the six pre-determined characteristics as controls in our regressions.

The next section reports the regression results.

3.7 Results

The results are divided into two parts. The first shows the results of impact of access to an additional source of credit on borrowing and income of the respondents. The second presents the results of borrowing on subsequent impact on psycho-social wellbeing of the respondents. We present the graphical plots of the outcomes of interest in Figures 3.4-3.6. In tables 3.4-3.6, we report RD estimates of the effect of multiple branches of credit on outstanding and delinquent loans and its subsequent effect on psycho-social wellbeing. In the even-numbered columns, we report estimates from regressions where we control for the pre-determined characteristics of the women including age, age-squared, education, religion, parental characteristics.

Our outcomes of interest related to borrowing are:(i) outstanding debt; (ii) number of outstanding loans; (iii) amount of delinquent debt; (iv) number of delinquent loans. Outstanding debt is defined as the sum of loans which had not been repaid at the time of the survey. Delinquent debt is defined as the sum of loans that were still outstanding one year or more after the end of the repayment schedule. In addition to borrowing, we examine monthly income of borrowers. Outcomes for the psyscho-social wellbeing indicators of the women include overall happiness, life satisfaction, financial satisfaction and health satisfaction of individuals.

Figure 3.4 shows the RD plots for outstanding amount and number of loans. Both figure 3.4 (a) and 3.4 (b) show small negative discontinuities at the threshold indicating a decrease in outstanding debt when women have access to a second MFI branch.

The formal estimation results are presented in Table 3.4. The amount of outstanding loans decreases by approximately BDT 3470 for the women with access to 2 MFI branches when the specification includes controls for the covariates (significant at the 1% level). This estimate is approximately 81% of the average amount of outstanding loans of the sample. The effect is also In addition, the number of outstanding loans decreases by 0.07 (significant at the 10% level) when the specification includes controls for the covariates.[14] The estimate is approximately 35% of

[14]The estimates are significant over a wide range of bandwidth including the optimal data-driven

the average number of outstanding loans of the sample. These estimates imply that access to a second MFI branch leads to a substantial reduction in the amount of outstanding loans and a small reduction in the number of outstanding loans. Amount of outstanding loans decline by 28% of the average monthly income of the sample when the respondents have access to a second MFI branch.

Figure 3.5 shows the plots for amount and number of delinquent loans. There appears to be small discontinuities in both Figure 3.5 (a) and Figure 3.5 (b). Table 3.5 presents the formal results. We obtain positive estimates for the amount and number of delinquent loans. But they are statistically insignificant in both cases.

Figure 3.6 shows the plot for monthly income of borrowers. There appears to be no discontinuity at the cut-off. The formal estimation result is reported in Table 3.6. We do see any effect of an additional source of credit on monthly income of borrowers.

Next, we look at the psycho-social indicators to examine the effect of amount of outstanding loans instrumented by an additional source of credit on wellbeing of the women. The psychosocial indicators include overall happiness, financial satisfaction, life satisfaction and health satisfaction. Figure 3.7 shows the plots for the four psychosocial wellbeing indicators. There appears to be no discontinuity at the threshold in the plots. Formal estimation results are reported in Table 3.7. We find no effect on the psychosocial wellbeing indicators of women when they have outstanding debt. The effect estimated is quite close to zero for all four indicators.

3.8 Discussion

Financial inclusion is advocated for bridging the poor to the formal credit market. Over the past four decades, it has been established that the poor are capable of banking through the growing microfinance institutions around the world. Recently, several microfinance markets have faced instability and borrowers have increasingly experienced over-indebtedness in various forms. In light of the emerging literature, this chapter empirically estimates the impact of multiple sources of credit on borrowing. We find that an additional source of credit lowers outstanding debt by BDT

bandwidth based on data variability.

3470 which is approximately 81% of the average outstanding debt for the sample. When the borrowers have access to a second branch of MFI their amount of outstanding debt decline by about 28% of their average monthly income. It also reduces the number the loan outstanding of borrowers by 0.07 which is approximately 35% of the number of outstanding loans for the sample.

The existing literature has argued that MFI clients borrow from multiple sources because the MFIs are unwilling to provide loans of sufficient size (Mpogole et al. 2012). Therefore, the MFI clients borrow from multiple institutions to obtain the desired amount of credit. There are two ways in which the additional loans may be used. First, they allow the borrower to extend the overall loan duration (by using new loans to repay previous ones). Karim (2011) in her enthnographic case studies in Bangladesh found that in presence of multiple MFIs the clients borrowed from multiple sources to repay existing loans. The study found that prevailing social norms led women to give away the loans to male family members. Therefore, the women were compelled to borrow from multiple sources to repay the existing loans.[15] This is also consistent with Krishnaswamy (2007) where the author found better repayment record with multiple loans among clients in India. This was because 75% of the clients had taken multiple loans to repay existing loans.

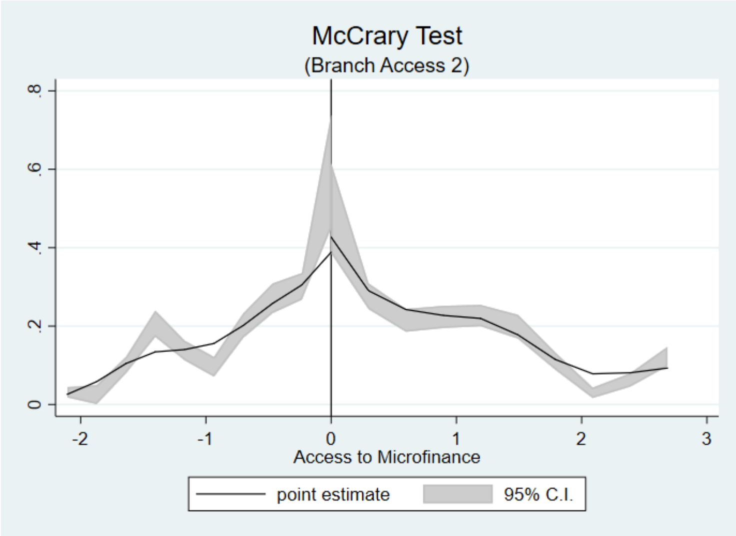
Second, additional loans enable the borrower to undertake larger investments than what would otherwise be feasible, raise household income and improve the household's capacity to repay existing debt (Field et al. 2012). In both cases, the addtional source of credit would lead to lower debt. Intuitively, there could be a few more possible reasons leading borrowers to have lower debt when the borrow from multiple sources. Borrowers could choose to borrow from multiple sources to pay-off exisitng debt because repayment failure leads to harsher future loan terms or a loss in future prospect of borrowing from the MFI. However, we find no effect of an additional source of credit on loan delinquency. This may be because the mean number and amount of delinquent loans in the sample is quite small. The findings of this study are interesting as, according to the standard neo-classical economic theory, an additional source of credit should not have any effect on debt. This is because in presence of perfect information and competition among MFIs, an additional source of credit would not give the borrowers the opportunity to obtain larger sum of loans from multiple sources or re-shuffle loan repayments. However, we do not find any

[15]Her study also suggests that MFIs promote multiple borrowing to capture a larger client base.

effect of an additional source of credit on monthly income of borrowers.

In addition, we find no effect of lower debt on psycho-social wellbeing of borrowers. There is limited causal evidence on impact of outstanding debt on wellbeing of microfinance clients. However, our results are in line with the evidence of Angelucci, Karlan and Zinman (2013). The authors in their randomized trial in Mexico found no effect of group-liability loans on life satisfaction or economic status of borrowers. Reflecting on the existing literature on borrower welfare of microfinance clients, we provide evidence that an increase in access to credit does not necessarily lead to over-indebtedness among MFI clients. It rather leads to a decline in debt. In addition, an increased debt does not have a negative effect on borrower welfare, in terms of psychosocial wellbeing of borrowers.

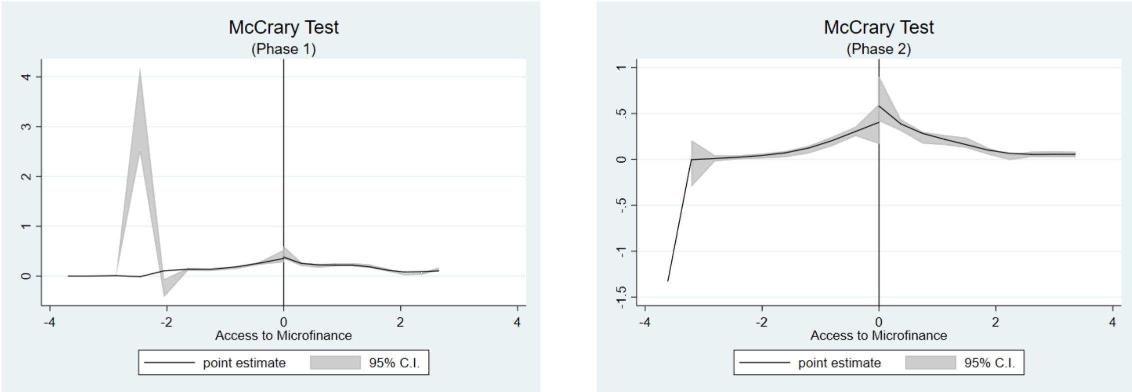
Figure 3.1: McCrary Test of Running Variable for Full Sample



(a) Full Sample

Note: The figure above demonstrate the McCrary test for the running variable. The plots shown here and all the figures below have the running variable ‘access to microfinance’ normalized at the centre in the x-axis. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

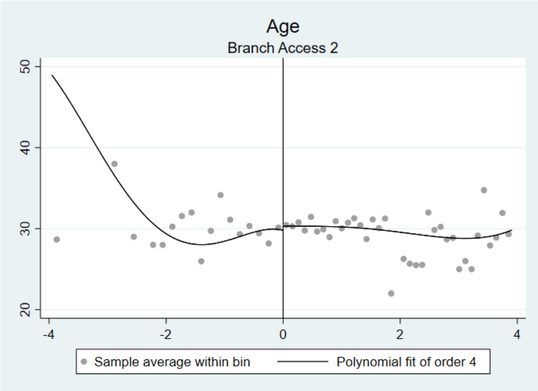
Figure 3.2: McCrary Test of Running Variable for Phase 1 and Phase 2



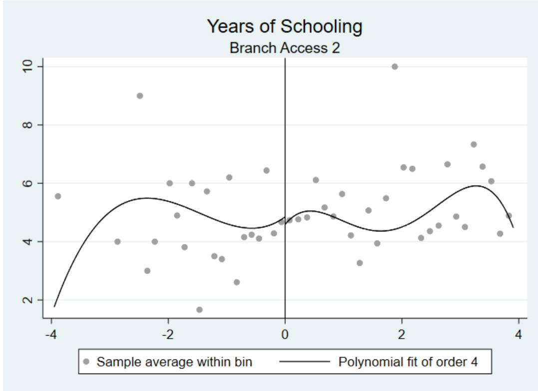
(a) Phase 1 (b) Phase 2

Note: The figures above demonstrate the McCrary density test results for the running variable to check for manipulation of treatment with the sample split into Phase 1 and Phase 2. Figure 3.2 (a) shows the plot for the sample of respondents interviewed during the first phase of the survey. Figure 3.2 (b) shows the plot for the sample of sisters of respondents of the first phase of the survey interviewed for the second phase of the survey. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

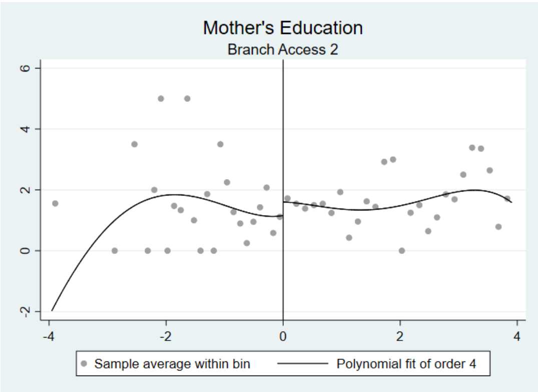
Figure 3.3: Pre-determined Characteristics Plots



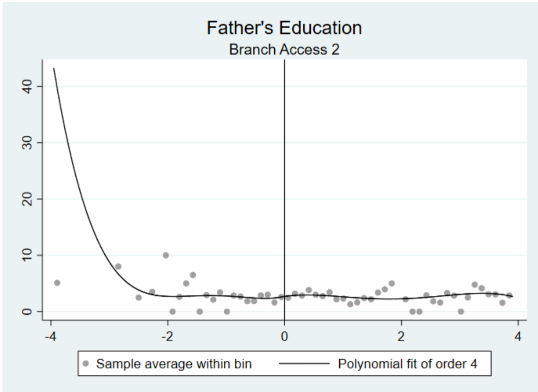
(a) Age



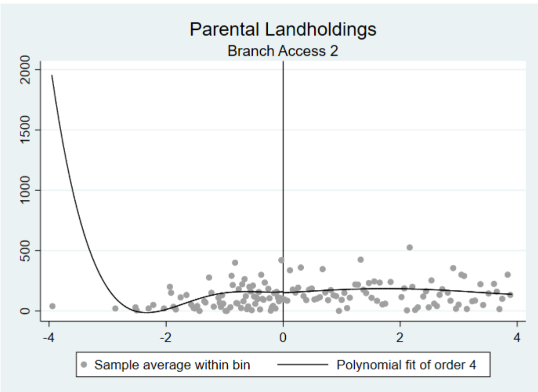
(b) Education



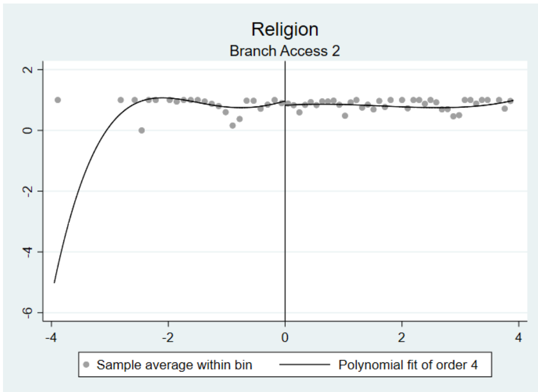
(c) Mother's Education



(d) Father's Education



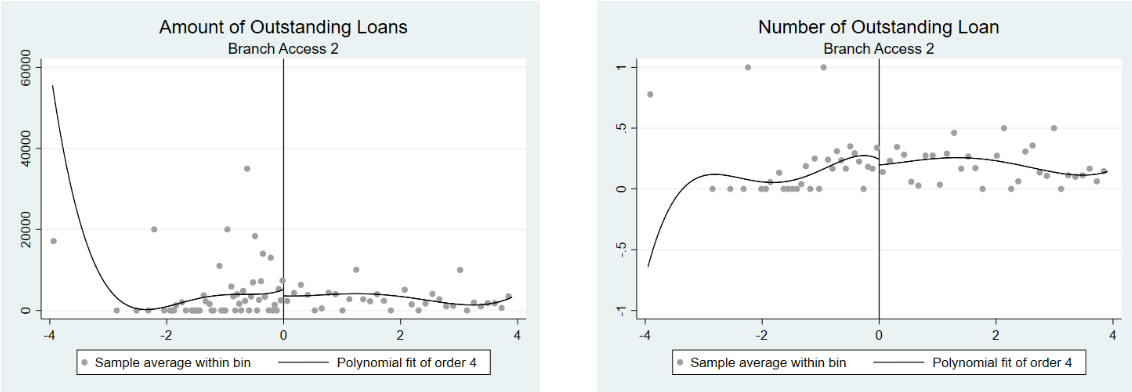
(e) Parental Landholdings



(f) Religion

Note: The figures above demonstrate the RD plots for pre-determined characteristics of borrowers. The plots shown here and all the figures below have the running variable 'access to microfinance' normalized at the centre in the x-axis and use a fourth polynomial and uniform kernel. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

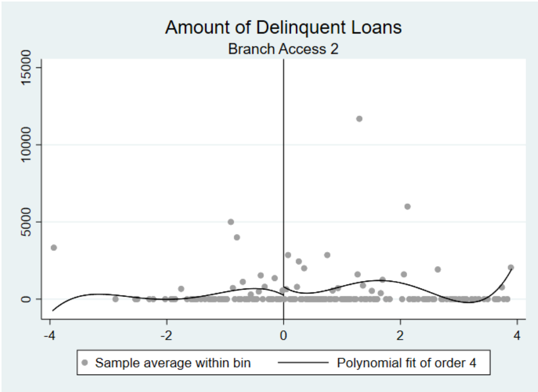
Figure 3.4: Amount and Number of Outstanding Loans: RD Plots



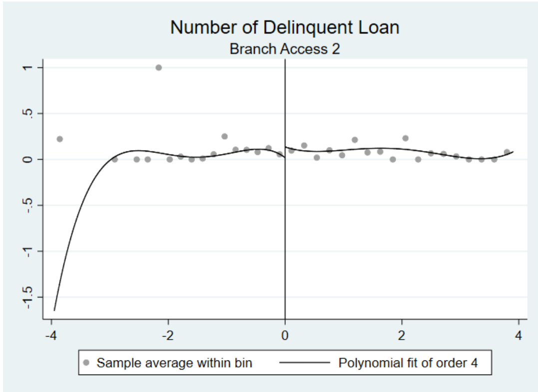
(a) Branch Access 2 (b) Branch Access 2

Note: The figures above show the plots for amounts and number of outstanding loans for Branch Access 2. Figure 3.4 (a) demonstrates the plots for outstanding amounts of loans of clients and Figure 3.4 (b) for outstanding number of loans. Branch Access 2 in the table above denotes that clients have access to two MFI branches. The dots represent binned sample means of amounts of outstanding loans and number of outstanding loans using a fourth order polynomial and uniform kernel. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

Figure 3.5: Amount and Number of Delinquent Loans: RD Plot



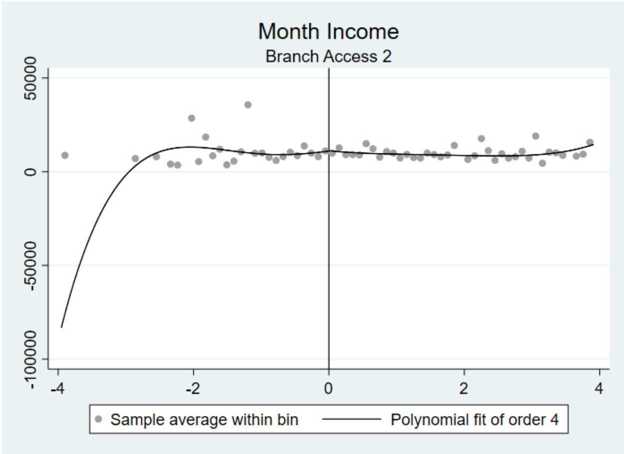
(a) Branch Access 2



(b) Branch Access 2

Note: The figures above show the plots for amount and number of delinquent loans for Branch Access 2. Figure 3.5 (a) demonstrates the plots for amounts of delinquent loans of borrowers and Figure 3.5 (b) for number of delinquent loans. Branch Access 2 in the table above denotes that clients have access to two MFI branches. The dots represent binned sample means of amounts of delinquent loans and number of delinquent loans using a fourth order polynomial and uniform kernel. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

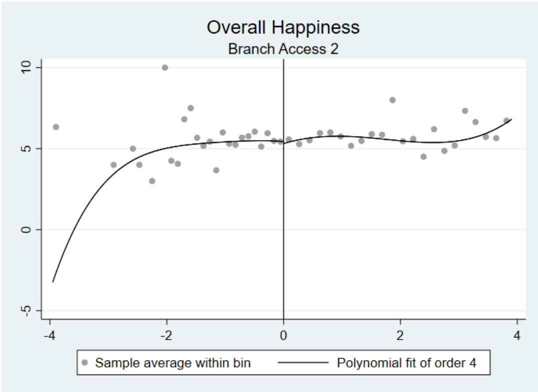
Figure 3.6: Monthly Income: RD Plot



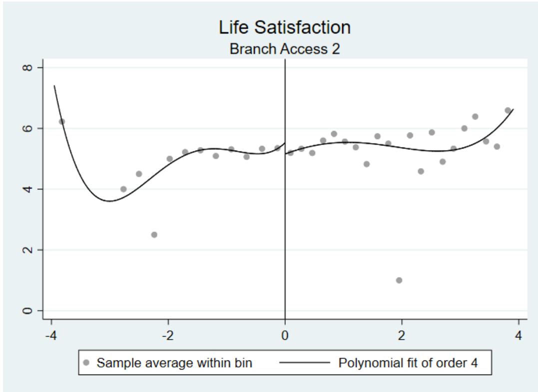
(a) Branch Access 2

Note: The figure above show the plot for monthly income of borrowers for Branch Access 2. Branch Access 2 in the table above denotes that clients have access to two MFI branches. The dots represent binned sample means of monthly income using a fourth order polynomial and uniform kernel. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

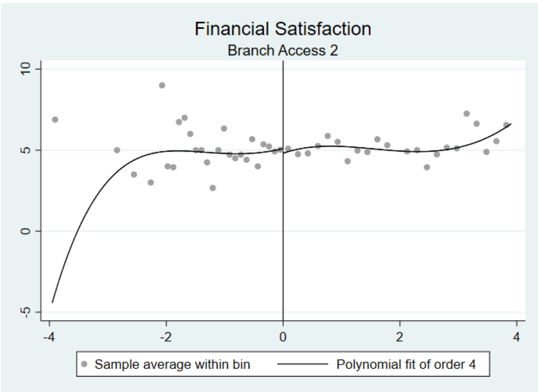
Figure 3.7: Psychosocial Wellbeing Indicators: RD Plots



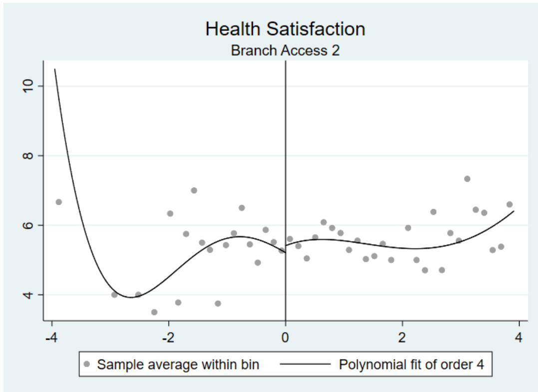
(a) Overall Happiness



(b) Life Satisfaction



(c) Financial Satisfaction



(d) Health Satisfaction

Note: The figures above show the plots for psycho-social indicators for Branch Access 2. Figure 3.7 (a) shows the plots for overall happiness, Figure 3.7 (b) for life satisfaction, Figure 3.7 (c) for financial satisfaction and Figure 3.7 (d) for health satisfaction. Branch Access 2 in the table above denotes that clients have access to two MFI branches. The dots represent binned sample means of the respective pyscho-social wellbeing indicators using a fourth order polynomial and uniform kernel. The centre shows the cut-off of operational rule with the negative value in the x-axis means that the individuals would have to travel some distance to be with the servicing area of the second closest branch. The positive value in the x-axis means that the individual is already within the servicing area of the second closest branch. The control group, with the negative distance, has access to a single branch of MFI and the treatment group, with the positive distance, has access to 2 MFI branches.

Table 3.1: **Sources of Loan**

Loan Composition	%
Loan from ASA	27.10
Loan from BRAC	13.51
Loan from Grameen Bank	28.42
Loan from Other MFIs	4.06
Loan from Commercial Bank	0.75
Loan from Informal Sources	26.18

Source: WiLCAS 2014 and Authors' Calculations

Note: The table above shows the percentage of loans borrowed from different sources in our sample. The three MFIs (ASA, BRAC and Grameen Bank) account for approximately 70% of the loans taken. Informal sources include family, friends, moneylenders, employer, shop owners.

Table 3.2: **Descriptive Statistics**

	Mean	Sd	Min	Max	N
Borrower Features					
Age	29.15	5.70	19	39	7,771
Monthly Income (in BDT)	12,218.94	63,089.77	0	5,000,000	7,771
Education (years of schooling)	5.27	3.79	0	13	7,771
Parental Landholdings (in acres)	1.39	2.77	0	60	7,771
Father's Education	2.97	3.88	0	13	7,771
Mother's Education	1.61	2.76	0	13	7,771
Religion (muslim)			0	1	7,771
Borrowing Profile					
Amount of Outstanding Loan from ASA, BRAC and Grameen Bank	4279.91	19547.68	0	900,000	7,771
Amount of Delinquent Loan from ASA, BRAC and Grameen Bank	997.46	11548.69	0	800,000	7,771
Number of Outstanding Loans from ASA, BRAC and Grameen Bank	0.2040	0.47	0	5	7,771
Number of Delinquent Loans from ASA, BRAC and Grameen Bank	0.0779	0.31	0	5	7,771
Psychosocial Wellbeing Indicators					
Overall Happiness	5.586	2.12	1	10	7,771
Financial Satisfaction	5.156	2.10	1	10	7,771
Life Satisfaction	5.405	2.065	1	10	7,771
Health Satisfaction	5.463	2.116	1	10	7,771

Source: WiLCAS 2014 and Authors' Calculations

Table 3.3: **Pre-determined Characteristics**

	Branch Access 2
Age	0.1896
	(0.914)
h	0.657
Obs around cutoff	[544, 888]
Education	0.0929
	(0.544)
h	0.722
Obs around cutoff	[544, 888]
Mother's Education	0.5124
	(0.325)
h	1.099
Obs around cutoff	[544, 888]
Father's Education	-0.0317
	(0.554)
h	0.685
Obs around cutoff	[544, 888]
Parental Landholding	-43.627
	(42.571)
h	0.572
Obs around cutoff	[544, 888]
Religion	0.0844*
	(0.058)
h	0.329
Obs around cutoff	[544, 888]
N	1432

Note: The table presents the local linear regression estimates for the pre-determined covariates of the borrowers. Religion is a binary variable which takes the value of 1 if the respondents are muslim and 0 otherwise. Branch Access 2 in the table above denotes that clients have access to two MFI branches. h is the data-driven bandwidth in kilometers taken around the threshold for estimation. Standard errors are given in parantheses. Statistical significance is denoted by robust p-values * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.4: **Amount and Number of Outstanding Loans**

	Branch Access 2	
	(1)	(2)
Amount of Outstanding Loan	-2978.70*	-3469.60***
	(1804.10)	(1803.00)
h	0.629	0.629
Obs around cut-off	[544, 888]	[544, 888]
Number of Outstanding Loan	-0.0560	-0.0669*
	(0.058)	(0.058)
h	1.223	1.223
Obs around cutoff	[544, 888]	[544, 888]
N	1432	1432
Controls	No	Yes

Note: The table presents the local linear estimates for amount and number of outstanding loans of borrowers. Outstanding loans are defined as the loans that the women had not repaid in full at the time of the survey. The estimates in column (2) include age, age-sq, education, religion, parental landholdings and parental education as controls. Branch Access 2 in the table above denotes that clients have access to two MFI branches.h is the data-driven bandwidth in kilometres taken around the threshold for estimation. Standard errors are given in parantheses. Statistical significance is denoted by robust p-values * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.5: **Amount and Number of Delinquent Loans**

	Branch Access 2	
	(1)	(2)
Amount of Delinquent Loan	216.53	214.66
	(508.80)	(505.63)
h	0.807	0.807
Obs around cutoff	[544, 888]	[544, 888]
Number of Delinquent Loan	0.0791*	0.0782
	(0.046)	(0.046)
h	0.732	0.732
Obs around cutoff	[544, 888]	[544, 888]
N	1432	1432
Controls	No	Yes

Note: The table presents the local linear estimates for amount and number of delinquent loans of borrowers. Delinquent loans are defined as the total loans that the women had failed to repay within the period of repayment schedule. The estimates in column (2) include age, age-sq, education, religion, parental landholdings and parental education of the women as controls. Branch Access 2 in the table above denotes that clients have access to two MFI branches. h is the data-driven bandwidth in kilometers taken around the threshold for estimation. Standard errors are given in parantheses. Statistical significance is denoted by robust p-values * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.6: **Monthly Income**

	Branch Access 2	
	(1)	(2)
Monthly Income	-67.83	63.027
	(1544.10)	(1506.60)
h	0.834	0.834
Obs around cutoff	[544, 887]	[544, 887]
N	1431	1431
Controls	No	Yes

Note: The table presents the local linear estimates for monthly income of borrowers. It represents the past month's income of the respondents reported in the survey. The estimates in column (2) include age, age-sq, education, religion, parental landholdings and parental education of the women as controls. Branch Access 2 in the table above denotes that clients have access to two MFI branches. h is the data-driven bandwidth in kilometers taken around the threshold for estimation. Standard errors are given in parantheses. Statistical significance is denoted by robust p-values * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7: **Psychosocial Wellbeing Indicators**

	Branch Access 2	
	(1)	(2)
Overall Happiness	0.0001	0.0000
	(0.000)	(0.000)
h	1.049	1.049
Obs around cutoff	[544, 887]	[544, 887]
Life Satisfaction	0.0002	0.0002
	(0.000)	(0.000)
h	1.014	1.014
Obs around cutoff	[544, 887]	[544, 887]
Financial Satisfaction	0.0002	0.0001
	(0.000)	(0.000)
h	1.039	1.039
Obs around cutoff	[544, 887]	[544, 887]
Health Satisfaction	-0.0001	0.0001
	(0.000)	(0.000)
h	0.637	0.637
Obs around cutoff	[544, 887]	[544, 887]
N	1431	1431
Controls	No	Yes

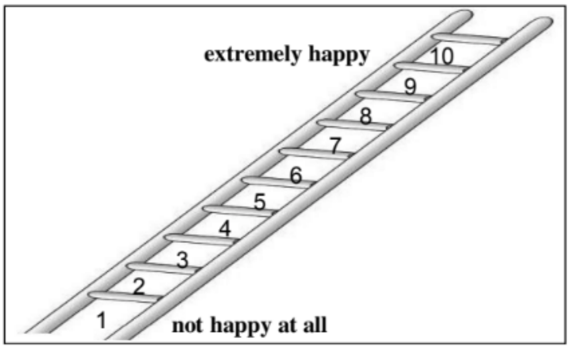
Note: The table presents the local linear estimates for the four pyschosocial wellbeing indicators when the borrowers have amounts of loans outstanding, where access to a second branch acts as an instrument. The psycho-social wellbeing indicators include overall happiness, life satisfaction, financial satisfaction and health satisfaction of the women. The estimates in column (2) include age, age-sq, education, religion, parental landholdings and parental education of the women as controls. Branch Access 2 in the table above denotes that clients have access to two MFI branches.h is the data-driven bandwidth in kilometers taken around the threshold for estimation. Standard errors are given in parantheses. Statistical significance is denoted by robust p-values * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.9 Appendix for Chapter 3

3.9.1 Psycho-social Wellbeing Indicators

The survey has a module on subjective wellbeing which has questions complying with Centre of Epidemiological Studies- Depression (CES-D) scale where the respondents were presented a 'Cantril Ladder Scale'. The survey respondents were asked how happy they were with their lives at the time, how satisfied were they with their household economic situation, how satisfied were they with their health situation and how satisfied were they with their lives in general considering the socio-economic factors. The Cantril Ladder Scale shown to the respondents had 10 steps where the respondents were asked to choose a step according to their wellbeing status subject to health, family and economic conditions. The 1st step meant that she was not happy at all and the 10th step meant that she was extremely happy. The ladder is shown in the figure below.

Figure 3.8: Cantril Ladder Scale



3.9.2 Branch Location Data: ASA, BRAC and Grameen Bank

We collected the branch location data of all operating branches of these three MFIs in Bangladesh in terms of district, upazila and union. For ASA and Grameen Bank that was the lowest administration classification available for the address of the branches. From the given classification, we have derived the geo-coordinates of the branches for this chapter. We could not find the geo-coordinates for 25 branches of Grameen Bank and 38 branches of ASA. Hence we dropped the branches from our analysis. For BRAC, the institution had the geo-coordinated of the street-level address of all of its branches available.

3.9.3 Microcredit Loan Contract and RepaymenTerms

MFIs in Bangladesh, especially the three largest MFI studied in this chapter, offer similar loan contracts in Bangladesh due to strong competition. A standard contract, following Grameen credit model, involves a contract of a sum of loan to repaid in weekly installments at the end of the grace period. Generally microcredit loans have a grace period of 2 weeks starting from the day the MFI hands over the loan to the client. The interest rate is charged by the MFIs is 12.5% as capped by the Microcredit Regulatory Authority (MRA). The length of a standard contract is 48 weeks.

When the borrowers are late with repaying their debt, the loan officers reschedule the repayment period. If the borrowers cannot repay within the new repayment period, at extreme scenarios the borrowers need to sell-off assets to repay the loans. For borrowers without any assets, the MFI refuses to give out any further loans. One of the incentives of timely repayment is better terms for future loans. Similarly, if borrowers are late with repaying their debt, they face harsher terms for future loans (Vogelgesang, 2001).

Chapter 4

Floods, Child Mortality and Schooling

4.1 Introduction

Developing countries tend to be more susceptible to exogenous shocks relative to developed countries. Poor households in developing countries find it particularly difficult to smooth consumption in presence of exogenous shocks such as natural calamity, political instability or war due to their weak socio-economic structure. In presence of such shocks, in order to smooth consumption, households rely on stringent coping mechanisms often sacrificing the needs of the most vulnerable group within the family such as children (Ogbu, 1987; Morduch, 1995; Foster, 1995). Existing literature highlights that negative income shocks lead to adverse effects on child outcomes such as school enrollment and educational attainment in low-income countries (Jacoby and Skoufias, 1997; Flug et al., 1998; Marchetta et al., 2018; Zimmermann, 2018).

South Asia is home to about 627 million children and an estimated 11.3 million children of primary school age do not go to school (UNICEF ROSA, 2019). The region is also responsible for 30% of global child mortality. The existing literature provides evidence of South Asia contributing significantly to the 100 million 'missing girls' in the world (Sen, 1990). Consistent with Sen (1990) a number of studies find an unbalanced sex ratio of children at birth as well as early years of childhood in India (Sharma, 2003; Fikree and Pasha, 2004, UNICEF, 2018). For India and Pakistan, studies show that a female child is around 50% more likely to die between her first and fifth birthday relative to a male child due to negligence, lack of preventive care and disparity in intrahousehold allocation (Gupta, 1987; Behrman and Deolalikar, 1988; George, 1997; Filmer et al, 2004).

Therefore, we try to link the well-established strands of the literature in development economics regarding impact of weather shocks and early-life outcomes of children. South Asia, Bangladesh in particular, is historically known to be susceptible to frequent flooding. Floods in Bangladesh, on average, inundate 20% of the country every year making 21% of the population vulnerable (Dewan, Nishigaki and Komatsu, 2003). In an extreme case of flooding in 1988, 60% of the country was inundated causing a damage of worth USD 1.3 billion (World Bank, 1990). Therefore, in this chapter, we estimate the impact of incidence of floods on early life outcome of children as well as test for prevalence of gender disparity in poor households in Bangladesh. Given the context of Bangladesh, we take advantage of incidence of floods in the country as the exogenous weather shock. Floods translate into negative income shocks for the poor households in terms of massive devastation of crops leading to rise in food prices, unavailability of work for daily labourers, etc. (Rahman, 1989; Khandker, 2007; Del Ninno et al., 2003). In addition, floods also cause a direct health shock in terms of outbreak of water-borne diseases, malnutrition among children, etc. (Pelletier et al., 1993). Floods also heavily damage infrastructure of developing countries potentially leading children to drop-out of school.

We use a nationally representative household survey of women born between 1975-1994 combined with the river water level data from all flood stations across Bangladesh recorded by Bangladesh Water Development Board (BWDB) for the period 1974-2000 in this study. Using spatial and temporal variation in water levels recorded at weather stations close to major rivers in Bangladesh, we derive a binary flood measure that takes a value of 1 if the maximum water level during each year is 1 standard deviation or more above the long-run average of the annual maximum water level and takes the value of 0 otherwise. In addition, we construct flood count variable indicating the number of occasion the children had experienced flooding between the ages of zero and five. Then to locate the children affected by floods during the early years of life, we use the geo-referenced location of households and the flood stations to spatially match the households to the nearest flood stations segmented into quartiles to determine the magitude of flooding for the households to estimate if the number of flood shocks during birth year and up until the age of five cause a delay in school enrollment of children.[1]

In addition to early life outcome such as school enrollment, we also examine prevalence of gender disparity in mortality of children based on the exisiting evidence from developing countries that in presence of income fluctutations and adverse conditions, female children are marginalised relative to male children (Behrman, 1988; Rose, 1999). Thus, using the methodology of Rose (1999) we estimate girl child survival probability where the outcome of interest is probabilty that the gender of a child, conditional on being alive, is female. Female child survival is taken as the outcome of interest rather than child mortality because of the concern regarding under-reporting of incidence of girl child death.

Furthermore, there is another line of evidence which suggests that during such crises child health and subsequent early life outcomes take the deepest hit particularly when the households are credit-constrained (Foster,1995; Rashid, 1999). As access to credit is often argued to be an income smoothing tool in presence of idiosyncratic shocks, we introduce microfinance access for the households in the analysis. We incorporate access to credit into our analysis by using the branch location and establishment year data of the two most prominent microfinance institutions (MFIs) Grameen Bank and BRAC operating since 1974 in Bangladesh. We derive access to credit of households using an exogenous operational rule of MFIs regarding seeking and serving borrowers within a geographic distance of 4 kilometres radius. This allows us to examine if access to credit helps households to better cope with flood shock in order to smooth consumption.

In our analysis, we hypothesize that households experiencing the highest flood shock, thus the highest negative income, health and infrastructural shock, will have negative effect on early-life outcomes of children. Therefore, the households will have a higher possibility of a delay in school enrollment of children. Furthermore, in the instance of gender disparity, if present, the probability of the child to be female, conditional on being alive, will be lower. However, we do not find evidence of any impact of floods on probability of daughters being enrolled in school by the age of 8 or female child survival in our analysis. In addition, access to credit does not affect the outcomes for the poor households. This could potentially indicate towards for-

[1] Details on flood shock estimation using the deviation in maximum water level and distance quartiles is given in Section 5

mulating a finer measure to estimate the flood shock used in this chapter especially when flooding can be mapped in more than one way using different data of water level measures.

The remainder of the chapter is organised as follows. Section 2 discusses the related literature. Section 3 describes the context of floods in Bangladesh. Description of the data follows in section 4 and section 5 describes the methodology. The results are reported in section 6 and discussed in section 7.

4.2 Related Literature

The existing literature suggests that exposure to income shocks in early life has a substantial impact on mortality and morbidity of children and in subsequent years on educational attainment and employment outcomes. However, researchers often use rainfall measure as an indicator of exogenous shock using the evidence that higher rainfall translates into higher incomes for the poor households. In this section we discuss the papers using weather shocks in early life to examine various life outcomes at later stages.

Maccini and Yang (2009) use early life rainfall shocks to estimate an impact of income shocks on adult outcomes such as health, educational attainment and adult socioeconomic status for children in Indonesia. The authors examine rainfall shocks for several periods before and after birth using a detailed household survey[2]. They also test for gender bias by splitting the sample for men and women to find that higher rainfall during early life resulted in better schooling, improved health and socioeconomic status for women in constrast to no effect on men. More precisely, a 20% higher rainfall in the year of birth of women led them to have completed 0.22 more years of schooling with 0.57 centimeters of more height and they were also 3.8 percentage points less likely to report themselves to be in poor health and economic condition.

On the other hand, Alderman et al (2006) examine similar outcomes for children in rural Zimbabwe by using civil war and drought as the exogenous shock faced dur-

[2]The method is inspired from the work by Almond (2006) where the author examines exposure to in-utero influenza in the 1920s to examine impact on adult outcomes in the post-1940s in the population of US.

ing the first three years of life. The authors estimate that the children lost out on 3.4 centimetres of height and 0.85 completed years of schooling and also experienced a delay of around 6 months in school enrollment compared to children in developed countries. They also extend their analysis to calculate the loss in the mentioned outcomes and suggest that children experienced a loss of around 14% of their life-time earnings due to micronutrient deficiencies experienced in early childhood as a result of the shock. Although there is an extensive literature studying pre-school nutritional status as a determinant of human capital attainment, the papers mentioned above provide firm causal evidence on the subject.

In addition to rainfall and drought shocks, there is a small set of papers looking at impact of extreme precipitation shocks termed as floods during early life on medium-term outcomes such as anthopometric and cognitive development outcomes of children. Aguilar and Vicarelli (2011) examine El Nino floods in Mexico as an early life weather shock to examine test scores in language development, working-memory and visiual-spatial thinking abilities among children. They measure the flood exposure by calculating the magnitude of deviation of precitation from the historical average monthly rainfall using a monthly precipitation gridded dataset. The authors test the effect from in-utero condition to the second year of life of children to find that children exposed to the shock for the first two years performed the worst with their scores 21, 19 and 13 percent lower in language development, working-memory and visual-spatial thinking respectively than children not exposed to the shock. Furthermore, the exposed children were 0.71 inches shorter and weighed 0.84 lbs less than others. They also find that households exposed to flooding two months after the shock reported to have 39% lower income relative to the ones not exposed. In addition to child outcomes, the paper sheds light on introduction of a conditional cash transfer program targeting poor households during the period of study. However, there was no evidence of a positive impact of the program on consumption during the shock corroborating with the results of other papers on anthropometric and cognitive developement from randomized poverty reduction programs (Fernald and Gertler, 2008; Paxson and Schady, 2008).

There is a small branch of the literature on floods impact in Bangladesh. Studies carried out after devastating floods in Bangladesh find that more than 70% of the households affected by the flood sold their landholdings and livestock as a coping strategy (Haque and Zaman, 1993; Del Ninno et al, 2003) which is in line with other studies in sub-Saharan Africa consistently finding evidence of sales of livestock helping in consumption smoothing during rainfall shocks (Fafchamps et al, 1998; Fafchamps and Lund, 2003; Kazianga and Udry, 2006). Another prominent coping mechanism that surfaced in the papers seemed to be access to aid during the crisis to cushion the shock in Bangladesh. Khandker (2007) using a household survey of 104 villages in Bangladesh shows that around 80% of the households which endured the most severe flood damage in 1998 raised cash funding for themselves through the aid agencies after the flood. However, more than half of all the affected households sought refuge in a range of coping mechanisms such as selling of asset, skipping meals or borrowing from informal sources. After controlling for the household characteristics the author finds that flood incident reduced household welfare and made them more likely to be poor after the incident. The paper also suggests that the households with microfinance access borrowed more during floods resulting in an increase in welfare through raised consumption and landholding. In line with the evidence of Khandker (2007), Rahman (1989) finds that farmers and wage labourers became increasingly prone to starvation during floods in Bangladesh due to seasonal rise in food prices and decrease in demand for wage labourers. In contrast, there are papers which argue that flood losses are compensated in the years after the shock for the rural households involved in farming in Bangladesh. Hurdus (1988) and Brammer (1990) find that floods which lasted for prolonged periods in terms high water levels in extensive areas in effect played a 'compensatory' role in crop damage by making the soil more fertile especially for the crops grown over the subsequent dry seasons.

Having reviewed the literature on shocks and consumption smoothing, we also find substantial evidence on female child mortality being higher relative to male due to differential resource allocation across gender especially in presence of an exogenous income shock (Rosenzweig and Schultz, 1982; Razzaque et al, 1990; Behrman, 1998). However, estimating female child mortality is quite tricky as there is another line of literature providing evidence that due to presence of strong gender preference where a son is preferred over a daughter, there is a tendency of underreporting of female birth and mortality (Miller,1989; Sen, 1990). Furthermore, negligence towards daughters may also result in death at an early age and the numbers go unreported, thus creating a downward bias on female child mortality.

Rose (1999) uses a novel methodology for estimating gender disparity among children in India where the estimation technique uses probability of a girl child surviving until school age relative to a boy. It takes the ratio of survival probabilities as the variable of interest in presence of rainfall shock rather than mortality of children. The rainfall shock, as commonly used in the literature, is used as a proxy for exogenous positive income shock. Hence, the methodology allows to estimate gender disparity in presence of an exogenous shock without the possibility of a systematic reporting bias. The author finds that in presence of a positive income shock in terms of positive rainfall in first two years of life significantly increases the probability of the gender of a child, conditional on being alive, is female. The sample is further split into landed households and landless households to test for any impact of parental landholdings. The rainfall effects are stronger for landless households suggesting that landless households are more sensitive to rainfall shocks relative to the landed households. In this chapter, we add to the methodology by introducing credit access for the households. This is particularly interesting as in presence of negative income shock access to a credit source would allow households to smooth income variations. Thus, it should reduce the impact of the shock.

Although there are a few studies on the impact of flood with respect to health and mortality of children in developing countries including Bangladesh, this chapter adds to the literature by using a nationally representative sample with cohorts born between 1975-1994 combined with long term historical flood data and introducing credit access using microfinance institution branch data across Bangladesh.

The next section describes the context of floods in Bangladesh.

4.3 Background

Bangladesh is historically known to be prone to natural calamities, especially floods. Positioned at the largest delta of the world, Bangladesh consists of 80% floodplain with three main rivers and numerous distributaries. The country also has a subtropical monsoon climate with approximately 80% of the yearly rainfall occuring during the season of monsoon (Plan International, 2019; IFRC, 2019). Thus, heavy rainfall causing river overflow during the tropical monsoons often make the country susceptible to coastal flooding. Historically, the country has experienced several catastrophic floods namely in 1987, 1988, 1998 and 2004. Of the ones mentioned, floods in 1988 and 1998 had the most severe impact with 60% of the nation inundated in 1988 and 75% in 1998 affecting approximately 30 million people (Brammer,1990; Reuters Report, 1998; Rasheed, 2008; Younus, 2010).

The economy of Bangladesh was primarily agrarian with over 70% of the population living in rural areas and relying directly on agricultural farming around the 1980s (Bangladesh Bureau of Statistics Reports). Although, due to structural transformation in the manufacturing sector of the country, the share of contribution of agriculture sector in the GDP has declined over the past decades but it still remains the main source of livelihood for the poor. Floods in Bangladesh, like most weather shocks in developing countries, have been observed to have disproportional impact on the population, affecting the poor the most because of their extreme vulnerability (Khandker, 1995; Morduch, 1998). Along with the direct costs, households exposed to flooding face various consequences such as deterioration in health and sanitation outcomes due to outbreak of water-borne diseases. In addition, floods lower the levels of consumption leading to malnutrition in children due to the negative income shock particularly for the instances when flooding persists for prolonged period. For instance, flood in 1998 in Bangladesh lasted for 67 days which caused the impact to deepen (IFPRI, 2001).

Flood risk is particularly high for regions in close proximity to large rivers due to tendency of rising water level causing river overflow. However due to scarcity of land relative to density of population and enriched soil quality at the river banks, the poorest households establish farms close to the river bank which make these households more susceptible to flood impact. Furthermore, contextually, landholding is usually the most valuable and only asset of the households thus reducing the feasibility of relocation. Hence, these households may not be able to smooth their consumption during the negative income shock in presence of floods. This is more so the case for the 40% of the poor of the country who live under the poverty line. The devastation due to severe flooding had been so widespread in 1988 that government with support of World Bank introduced 'Flood Action Plan' to cushion the blow. Del Ninno and Lundberg (2005) suggests that the relief efforts resulted in a portion of households being able to smooth consumption. However, the rest of the households had to make 'heavy sacrifices' during the flood and also a few years after the flood. This inadequate consumption during and after the flood often lead to malnutrition among the children (as reviewed in the previous section).

Negative consequences of malnutrition during childhood are proven to be one of the primary reasons behind under-5 mortality of children as it weakens the immune system of the children making them more susceptible to opportunistic infections. Pelletier et al. (1993) finds that more than 50% children who had passed away before the age of 5 in most developing countries were subject to mild to severe malnutrition. In addition, malnutrition is often found the reason behind lower intellectual ability, educational attainment and productivity. Del Ninno and Lundberg (2005) also shows that malnutrition has prolonged effect on health outcomes of children including lower cognitive development, lower body size and height. However, the study does not examine school attainment as an outcome.

Although literature on Bangladesh suggests that the country has built a degree of resilience to cope with the repeated incidence of floods over the years, there is little evidence on whether, and to what extent, exposure to flooding in childhood affects subsequent outcomes. School enrollment has strikingly been low during the period of our study (Bangladesh Bureau of Statistics reports, 1990-1992) and economic shocks such as floods are often known to damage rural infrastructure including schools making it harder for children to attend schools. Development agencies such as Save the Children and World Bank claimed that 19,000 schools were damaged in Bangladesh during the floods of 1988 and 1,718 schools during the flood in 1998 and had anticipated that hundreds of thousands of children were at risk of falling out of the school system especially when education was not prioritized in the relief programs of goverment (BBC, 1998; World Bank, 1999). However, not many empirical studies looked at the school outcomes of children as well as differential intra-household allocation leading to higher probability of mortality of female children for Bangladesh. This motivates us to look at the impact of floods on school enrollment of children in Bangladesh. In addition, we look at female child survival for prevalence of gender bias.

The next section discusses the data used for the empirical analysis of the paper.

4.4 Data

The empirical analysis of this chapter uses three different datasets: the 2014 Women's Life Choices and Attitudes Survey (2014 WiLCAS), Bangladesh Water Development Board (BWDB) data on annual river water level from 1974-2000 and branch location data of two key microfinance institutions in Bangladesh: BRAC and Grameen Bank.

4.4.1 Household Survey Data

The 2014 WiLCAS is a nationally representative survey of women in Bangladesh across all 64 districts. The sample for this survey was selected from the 2010 Bangladesh Household Income and Expenditures Survey (HIES) and includes all rural households in HIES with one or more female household members aged between 16 and 35 years in 2010. Asadullah and Wahhaj (2018) conducted the survey for a project funded by Australian AID.[3] We use the 2014 WiLCAS in our analysis as the survey includes precise location of birth of respondents. The survey consists of individual interviews of adult women which include their background information such as year and location of birth and parental characteristics including parental landholdings, education and occupation. It also includes education outcomes of the women including age of school enrollment. In addition, the survey has a module on siblings of the women where they report information on their brothers and sisters. Data on siblings include gender of all siblings and records if the sibling was alive or had passed away at the time of the survey. For the deceased siblings of the respondents, the survey has the age at which they had passed away. The survey has information on 6,293 respondents and 26,960 siblings. In our analysis, we only include the sample of respondents and the siblings who were alive at the time of the survey.

4.4.2 Flood Data

In order to compute the flood shock at the location of birth of each respondent and sibling, henceforth referred to as children, for the birth year and several periods after that, we collected historical river water level data for 370 flood stations across Bangladesh for the years 1974-2000. There were 281 flood stations in Bangladesh in

[3] More details about the survey can be obtained from the website www.integgra.org

1974. By the end of 2000, the number of flood stations had risen to 370. However, we do not have data for all stations for the 27-year period. This is because flood stations were added gradually through the years and some stations were closed off due to changing flow of rivers. For our analysis, we only use the stations with data available for 25 years or more giving us a final sample of 240 flood stations across Bangladesh. The data include annual records of maximum and minimum river water levels for each flood station with the respective geo-referenced location.

Using the geo-referenced location of the flood stations we spatially match the children in the survey with the nearest stations in each year at the union level.[4] We use the geo-referenced location of birth of each respondent of the survey to identify the union in which she was born in. Amirapu, Asadullah and Wahhaj (2018) provides evidence, using the 2014 WiLCAS, on neglible post-marriage migration. Hence we assume that mothers of the respondents have resided at the location of birth of respondents throughout their upbringing.[5] Following this, we further assume that the siblings of the respondents were born at the same location as the respondents. For our analysis, we exclude the children for whom we could not retrieve the geo-coordinates of the union of birth.[6] In addition, we include only the respondents and their siblings born between 1974 to 1994 to correlate with our flood data. This gives us a final sample of 4,000 respondents and 10,057 siblings.[7]

In our analysis, we construct a measure of the flood shock for each household at the union level. The flood shock for each household is measured using deviation in maximum river water level in each year from the historical average for the 27-year period. Then, we take the average of the deviations for the four nearest flood stations to the respondent's union of birth to give us the average flooding level at the union level. The flood measure is a binary variable that takes a value of 1 if the maximum water level during the year is 1 standard deviation or more above the 27-year average of the annual maximum water level, and takes a value of 0 otherwise.[8]

[4] Union is the smallest rural administrative and local government unit in Bangladesh.

[5] This has been explained in details in the data and identification strategy section of chapter 3.

[6] We matched the union of birth of the respondents in the survey with the geo-referenced union list of Bangladesh Bureau of Statistics (BBS). We could not match 1,352 unions of birth of respondents with the listed unions of BBS. This could be because administrative classification in Bangladesh changed over the past decades. Hence, we could not retrieve the geo-referenced location of birth of the respondents born in the respective unions.

[7] Please refer to Appendix 4.8.1 for details.

[8] A metric based on either three or five closest flood stations does not substantially change the estimated effects.

This will be explained in more details in the next section.

4.4.3 Microfinance Institution Data

To estimate if access to credit plays any role for our outcomes of interest, we derive access to microfinance for mothers of the respondents and siblings from the branch location and establishment dates of all microfinance operating branches of Grameen Bank and BRAC across Bangladesh from 1974 to 2000. There are 3 large MFIs in Bangladesh: ASA, BRAC and Grameen Bank. We particularly focus on BRAC and Grameen Bank as these MFIs were established in mid-1970s and had expanded from around mid-1980s which fits well with our analysis.[9] The two MFIs account for around 18 million borrowers of nearly 40 million borrowers in Bangladesh. We retrieved 2042 geo-referenced branch locations at the union level of BRAC (Bangladesh Rural Advancement Committee) and 2521 branch locations at the union level of Grameen Bank.[10] We use geo-referenced location of the mother at the time of the respondent's birth at the union level. Then, we spatially match the branches with the union of birth of children to calculate the distance between the households and the bank branches to derive access to microfinance for the mothers. To determine access to credit, we use the exogenous rule of operation of the MFIs of covering a geographic distance of 4-kilometer radius to seek and serve borrowers.[11] If the households are located within the 4 kilometer servicing area of at least one branch of the MFIs in the mothers are considered to have access to credit. Similary, when the households are located beyond the servicing area, the mothers are considered to have no access to credit. Therefore, we filter out the branches of these two MFIs to derive mothers' access to credit when the children were of the respective ages of 0 to 5. To estimate the impact of access to credit on the outcomes, we construct two flood count variables; the first indicates the number of occasions the child had experienced flooding between the age of zero and five when the mother did not have access to credit; the second provides a corresponding measure for periods when the mother had access to credit.

[9] ASA was established in 1978 but started the credit programme in 1992. It was not until the late 1990s when the credit programme had reached nationwide. For more information, please refer to Appendix 2.9.2.

[10] See Appendix 4.8.2 for more details

[11] Please refer to the previous chapters for more details on the operational rules of the MFIs in Bangladesh.

4.4.4 Descriptive Statistics

Table 4.1 demonstrates some descriptive statistics for the key variables of this chapter. The mean age of the respondents is 29 years with a standard deviation of around 6 years. For school enrollment of the respondents we use a binary indicator denoting if the respondent has been enrolled to school by the age of 8 and we observe that approximately 74% were enrolled by the age of 8. For parental characteristics, average parental landholding is 1.40 acres of land with a standard deviation of 2.77 acres. Education of fathers on average is around 3 years of schooling with a standard deviation of 4 years. Mothers seem to be, on average, half as educated as fathers with approximately 1.62 years of completed education and a standard deviation of 3 years. This seems to demonstrate that the parents on average did not complete primary schooling and a significant gender disparity prevailed in terms of education. In addition, 19% of the fathers in our sample are employed in low paying occupation where labourers and artisans are classified as low-pay workers. Respondents experienced 0.75 floods on average within the ages of 0 to 5 when their mothers did not have access to credit and 0.278 floods when their mothers had access to credit.

Siblings

The average age of siblings is approximately 30 years of age with a standard deviation of around 6 years. This seems to be quite similar to that of respondents. For the siblings, we test for prevalence of gender disparity in survival probability. Approximately 46.7 % of the siblings are sisters who survived till the age of 5. The survey includes information on siblings who had passed away. We only include the siblings of the respondents who were alive at the time of survey exclude the deceased sibling from our sample as outcome of interest in survival probability. Siblings of respondents experienced 0.74 floods on average within the ages of 0 to 5 when their mothers did not have access to credit and 0.263 floods when their mothers had access to credit.

Water Level Measures

Next, we report the water level at the weather stations statistics for respondents and siblings. As mentioned above, we use the annual maximum water level of rivers for each flood station in each year to construct a measure of the flood shock. The water level deviation measure, which is our flood shock, for respondents on average is 0.17 standard deviation and for siblings is 0.16 standard deviation for the period of study.

4.4.5 Access to Credit

Table 4.2 shows the proportion of households with access of credit for the early years of life of children. It can be observed that access to credit increases for the households over the years which is in line with the history of expansion of MFIs in the 1980s. The proportion of households with access to credit is strikingly low for the period of our analysis because the micofinance sector in Bangladesh had experienced a boom in the mid 1990s after it was listed as the poverty elimination tool for the Millennium Development Goals (MDGs) (UNICEF, 1992).

The next section describes the measure of our flood shock and the empirical strategy of the study.

4.5 Methodology

There is a large literature in development economics on the impact of weather shocks on early life outcomes of children. In this study, we use the incidence of floods as the exogenous shock. There are various methods of measuring weather shocks in the existing literature. However, flood shocks are not as widely used as rainfall level measures in the literature. Therefore we construct our flood measure based on the standard procedure for constructing measures of rainfall shocks in the literature.

4.5.1 Measure of Flood Shock

In order to precisely determine the extent of flooding of the households, we spatially map each household with the flood stations. We calculate, for each household in each year, the average of the geographic distance to the four closest flood stations. We use this distance measure to categorise the households into quartiles. The quartiles give us an idea of proximity of households to the river as flood stations are always positioned close to the river banks. To deduce the incidence of flooding for the nearest flood stations to the individuals, we compute deviation of maximum river water level, (WL_{ky}), of each of the four flood stations k in each year y from the 27-year average maximum water level of the station, $(\sum \overline{WL_k})$, divided by the long run standard deviation of the maximum river water level σWL_{ky}. Then, for each household and each year, we compute the average, across the four closest flood stations, of the deviation of the water level for that year from the long-term average for that station (q represents each quartile). We use the maximum water level of the year as that would be the most precise estimate of the peak of monsoon river flooding.

$$WD_{iy} = \frac{\sum_{q=1}^{4}(WL_{ky} - \sum \overline{WL_k})/\sigma WL_{ky}}{4} \tag{4.1}$$

where WD_{iy} is the water level deviation for each individual i at each year y. The flood measure, F_{iy}, is a binary variable that takes a value of 1 if WD_{iy} is 1 standard deviation or more at each year, and takes a value of 0 otherwise. Using this flood measure, we compute incidence of floods for each individual between the ages of 0 and 5. The flood measure has been crossed with flood reports from Ministry of Disaster Management of Bangladesh and the existing literature on flooding. Figure 4.1 shows the percentage of flooding according to our measure for the period of study from 1974- 2000. Figure 4.2 shows the percentage of maximum area flooded for the period 1954- 2008 (BWDB annual reports; Shahid (2012) and Braun and Abheuer (2011)). The years which experienced most flooding in both figures include 1974, 1987, 1988, 1998 and 1999 (as discussed in the Background section earlier). The existing literature and annual reports published by the government of Bangladesh derive flood measures at the district level. We construct a more precise measure and calculate the flooding extent at the union level. From the two figures, we can observe that our constructed measure is consistent with historical flood reports where a positive standard deviation in our measure coincides with flood record for that year in flood reports.

In addition, we construct two flood count variables based on the flood measure; the first indicates the number of occasions the child had experienced flooding between the age of zero and five when the mother did not have access to credit, D_i and D_j for respondent and sibling respectively ; the second provides a corresponding measure for periods when the mother had access to credit, E_i and E_j for respondent and sibling respectively.

4.5.2 Empirical Strategy

In order to answer our first research question whether exogenous flood shocks have an impact on early life outcomes of children, we examine probability of school enrollment of respondents as an outcome variable. Furthermore, to investigate prevalence of gender disparity in mortality among children, we examine probability of female sibling survival. For school enrollment of respondents, we look at probability of respondents to be enrolled in school by the age of 8 to detect if floods delay the enrollment in school. In our sample, the average age of enrolling in school is at around 7 years of age. Hence, we generate a binary dummy where it takes a value of one if the child is enrolled in school before the age of 8 and zero otherwise.

For detecting gender disparity in mortality among children, we use the methodology used by Rose (1999). Rose (1999) proposed the novel method of examining the probability of a child being female from a sample of all surviving children. This method eliminates the concern about underreporting of incidence of death of female children due to female infanticide. Following her work, we only use the sample of surviving siblings as our sample. As the sample of the 2014 WiLCAS includes only the households which had at least one female within the certain age bracket, we exclude the respondents and focus on their surviving siblings only while testing for gender disparity due to the concern of a potential bias. We do not estimate impact of flooding on child mortality as the outcome variable as the mortality data in the survey does not corroborate with the national child mortality statistics. For the period of study, the government of Bangladesh and the development agencies report child mortality to be approximately 10%. In our survey, it is found to be less than 2%. For this reason, we do not use child mortality as the dependent variable in our analysis.

In absence of gender disparity, flood shocks should not trigger gender-biased infant mortality. Thus, the probability that a sibling who is currently alive is female should be unaffected by exposure to flood shocks in infancy. Therefore, we apply the technique of Rose (1999) for the siblings of the respondents and take only the sample of siblings who were reported to be alive at the time of the survey. For the sample of surviving siblings, we generate a binary variable which takes the value of 1 if the sibling is female and zero otherwise.

We use a simple linear probability model to estimate the impact of flood shock during early childhood on female child survival and school enrollment age. We estimate the following equations for our analysis:

$$schoolenrollment_{ir} = \alpha+\delta Q_{ir}+\eta D_i+\theta(Q_{ir}\times D_i)+\zeta E_i+\lambda(Q_{ir}\times E_i)+\beta X_{ir}+\gamma d_i+u_{ir} \tag{4.2}$$

$$femalesiblingsurvival_{jr} = \mu+\nu Q_{jr}+\pi D_j+\tau(Q_{jr}\times D_j)+\kappa E_j+\phi(Q_{jr}\times E_j)+\sigma X_{jr}+\omega d_j+u_{jr} \tag{4.3}$$

where $schoolenrollment_{ir}$ is a binary variable which takes a value of 1 if respondent i born in union r was enrolled in school by age 8 and 0 otherwise and $femalesiblingsurvival_{jr}$ takes a value of 1 if sibling j of respondent i born in union r is female and 0 if the sibling is male. Q_{ir} and Q_{jr} are categorical distance quartile variables indicating the individual's average distance to the four flood stations respectively. D_i and D_j are the count of number of occasions the child had experienced flooding between the age of zero and five when the mother did not have access to credit and E_i and E_j are the corresponding measure for periods when the mother had access to credit. In this way, we hypothesize that there will be a negative impact of flooding on early-life outcomes, if any, in the first quartile interaction with the number of floods experienced. Subsequently, we test for the equality of coefficients of the two flood counts to detect an impact of access to credit. X_{ir} and X_{jr} include age and age-squared of the individuals and a set of family characteristics including parental education, parental landholdings and a dummy indicator to denote if the father is employed in low paying occupation. d_i and d_j are district of birth dummies and u_{ir} and u_{jr} are the idiosyncratic errors clustered at the level of the family.

There is a large literature on positive link between parental characteristics and child outcomes especially in terms of health of female children in developing countries (Rosenzweig and Schultz, 1982; Alderman, 1990; Behrman,1990). Numerous studies in developing countries such as India, Bolivia, Brazil, Guatemala found that women's autonomy, social class and literacy significantly influence child survival through the channel of improved child care in terms of immunization and nutrition attainment (Gupta, 1990; Hobcraft, 1993; Sastry, 1996; Pebley et al, 1996; Desai and Alva, 1998; Frost et al, 2005). Educated mothers have better knowledge and awareness about child health, preventive care and health services along with having greater decision making power within the household (Caldwell, 1986). In addition, Glewwe et al (2001) argues that child health and school attendance decisions for children are taken under the umbrella of the households allocation decision. Thus, household characteristics must be controlled for to remove the correlation between them for an unbiased identification. Hence, we use parental characteristics such as parental education, father's occupation status and parental landholdings as control variables to isolate the impact of flood. We apply district of birth and year of birth fixed effects for all children in our analysis to control for the differences across the children for socio-economic or geographic factors other than flooding following Asadullah and Wahhaj (2018).

Now we move on to our formal estimation results for the outcomes discussed above. The next section reports the empirical results.

4.6 Results

We estimate the impact of incidence of floods on early life outcomes of children and prevalence of gender disparity in mortality of children. As an early life outcome we examine school enrollment age of respondents. It is a binary variable which takes the value of 1 if the respondents was enrolled in school by the age of 8 and 0 otherwise. For prevalence of gender disparity in mortality of children we examine the probability of survival of female sibling of the respondents. The binary variable takes the value of 1 if the sibling of the respondent, conditional on being alive till the age of 8, is female. Table 4.3 reports the estimated coefficients for both school enrollment age and female sibling survival. All regression estimates reported in the table inlcude controls for age and age squared of the children, parental education, parental landholdings, fathers' occupation status, and district of birth of children. Table 4.4 reports the estimates for equality of coefficients.

4.6.1 School Enrollment for Respondents

Table 4.3 column (1) reports the estimated coefficients for school enrollment probability for respondents. The results show the estimates for school enrollment of respondents with and without credit access. The estimates provide no evidence that experience of flooding between the ages of 0 and 5 affects the probability of school enrollment. Then we test the hypothesis for equality of the coefficients of the two flood count variables at each distance quartile in Table 4.4 column (1). We cannot reject the hypothesis that the corresponding coefficients are equal. Therefore, access to credit has no impact on school enrollment of children in presence of floods.

Although we do not find any effect on probability of school enrollment with the constructed flood count, parental characteristics estimates are consistent and in line with the existing evidence. Respondents with higher parental education (by about 0.12 years for mothers and 0.11 years for fathers) and larger parental landholdings (by about 0.08 acres) were more likely to be enrolled in school by the age of 8 (significant at 1% level). In addition, respondents who had a father in a low-earning occupation (specifically, employed as labourers or artisans) were approximately 28.55 percentage points less likely to be enrolled in school by the age of 8 (significant at 1% level).

4.6.2 Female Sibling Survival

Next, we test for gender disparity in mortality of children. Table 4.3 column (2) reports the estimated coefficients for female sibling survival. The sample for this outcome consists of the siblings of the respondents of the survey. The results show the estimates for female sibling survival with and without credit access. The estimates provide no evidence that experience of flooding between the ages of 0 and 5 affects the probability of the surviving sibling, conditional on being alive, is female. Then we test the hypothesis for equality of the coefficients of the two flood count variables at each distance quartile in Table 4.4 column (2). For all the quartiles, we cannot reject the hypothesis that the corresponding coefficients are equal. Therefore, access to credit does not have any effect on female sibling survival.

Consistent with the estimates of school enrollment probability of respondents, parental characteristics such as parental landholdings and father's occupation status had an effect on female sibling survival. Female siblings with larger parental landholdings, by about 0.0039 acres, were more likely to survive (significant at 5% level). It can also be observed that female siblings who had a father in a low-earning occupation (specifically, employed as labourers or artisans) were approximately 2.71 percentage points more likely to survive (significant at 5% level). However, parental education had no effect on gender disparity in survival.

According to the estimates reported above for both of our outcomes of interest, we do not see any effect of flood shocks in line with our hypothesis stated earlier. As a robustness check, we calculate the power of the estimation to test if the sample size of our study is too small to estimate an impact. We calculate the sample size for a power of 90% at 5% level of significance hypothesizing the proportions of the outcome variables to be different from the sample mean. For school enrollment of respondents, the estimated sample size ranges from 154 to 244 for a power of 90%. For female sibling survival, the estimated sample size ranges from 173 to 512 for a power of 90% . This shows that the insignificant estimates in our analysis are not due to the sample size.

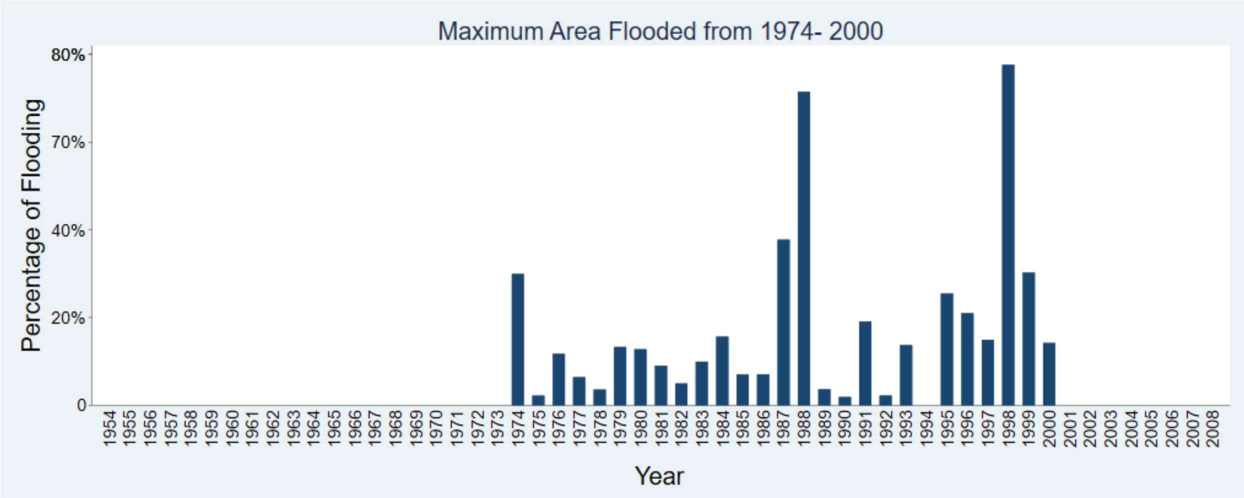
4.7 Discussion

In this chapter, we estimated the impact of exogenous weather shocks such as floods in Bangladesh on early life outcome such as probability of school enrollment of children by the age of 8 in poor households. We also test for presence of gender disparity in child mortality due to flood shocks. Following Rose (1999), we take the sample of surviving children only to estimate the probability that the gender of a child, conditional on being alive till the age of 8, is female. We construct a measure of flood shocks using deviation from long-run river water level. We map the flood stations with the household of children and estimate an impact of flooding for ages 0-5. We identify a positive 1 standard deviation or more of maximum water level in a given year above the long run average of maximum water level as flooding. In addition, we introduce access to credit for households. We derive access to credit of mothers when the children were within the ages of 0-5 to check if relieving credit constraints help households smooth consumption and not make heavy sacrifices. Subsequently, we take a count of number of flood events respondents and their siblings had experienced when their mothers did and did not have access to credit respectively. Building on the evidence of the existing literature, we hypothesized that flood shocks during early-life would lead to a negative impact on the outcomes mentioned. In addition, access to credit would help households cushion the multi-dimensional costs of floods such as income, health and infrastructural loss.

However, we find limited evidence of any effect of flooding on probabililty of school enrollment or female child survival in our analysis. In addition, access to credit did not have any impact on the outcomes. The results of our analysis can have three implications. First, the existing literature suggests relief efforts of development agencies during a severe natural calamity allow a significant portion of households to smooth consumption and cope with the costs in Bangladesh (Del Ninno and Lundberg, 2005). Secondly, a branch of the literature suggests that recurring incidence of floods has built an extent of resilience among households to a cope with flood shocks. Households can better prepare themselves before the start of the monsoon floods which masks the welfare loss to some extent (Brouwer et al., 2007). Therefore, an impact of recurring flood events is not detected in our analysis.

Lastly, our results raise a concern regarding the method used for constructing measures of flood shock. Although our measure of flood shock corroborates with the reports of government of Bangladesh on flooding, there are various ways of mapping flood events. The literature on weather shocks provides several ways of constructing measures of rainfall shocks for households for an impact on a range of outcomes. However, it is yet to conform to a standard way of measuring flood shocks as it has for measuring rainfall shocks. Therefore, we acknowledge the possibility that alternative measures of the flood shock would reveal a stronger link between flooding and early life outcomes. In addition, a broader set of outcomes both for medium and long term outcomes of children could be included in the analysis to study the impact of floods in Bangladesh. Floods might not impact the school enrollment however could affect the cognitive development and retention of children in schools in Bangladesh.

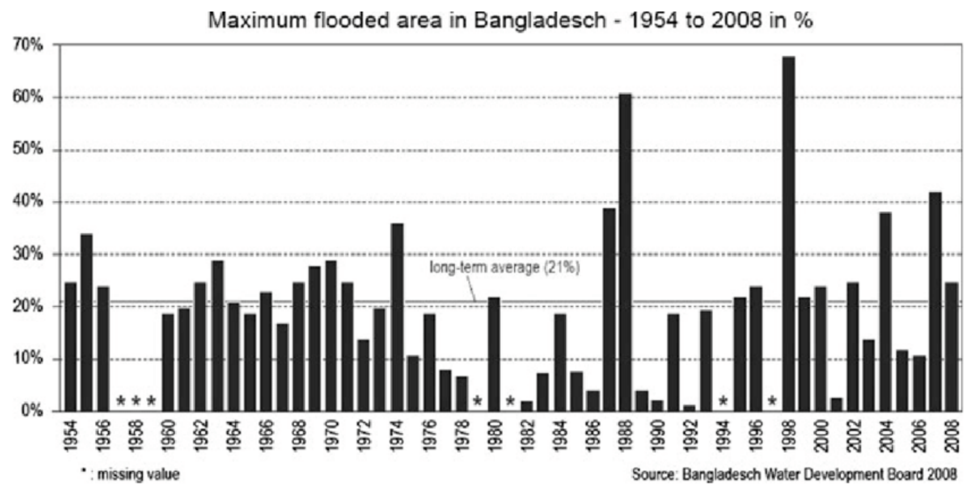
Figure 4.1: Proportion of Area Flooded from 1974-2000



(a) Flood Shock 1974-2000

*S*ource: BWDB 1974-2000 and Authors Calculation.
Note: The figure above shows the proportion of flooding of Bangladesh based on our flood measure. It demonstrates the percentage of flooding in each year for the period of our study: 1974-2000. We show the graph from 1954 to 2008 in order to correlate with BWDB report given below.

Figure 4.2: Maximum Flooded Area from 1954-2008 in BWDB Reports



(a) Flood Shock 1974-2000

Source: BWDB 2008 report, Shahid, S. (2012) and Braun and Abheuer (2011).
Note: The figure above shows the percentage of maximum area flooded for the period 1954-2008 reported in BWDB reports and calculated by the authors cited above.

Table 4.1: **Descriptive Statistics**

	Mean	Sd	Min	Max	N
Children Features					
Age of Respondents	29.040	5.582	19	40	3,997
Age of Siblings	29.506	6.077	19	40	10,051
Probability of Female Sibling Survival	0.471	0.499	0	1	10,051
School Enrollment of Respondents	0.744	0.436	0	1	3,997
Flood Count without Credit Access (Respondents)	0.754	0.888	0	4.524	3,998
Flood Count with Credit Access (Respondents)	0.275	0.662	0	4.517	3,998
Flood Count without Credit Access (Siblings)	0.737	0.499	0	4.758	10,051
Flood Count with Credit Access (Siblings)	0.263	0.436	0	4.721	10,051
Parental Landholding	1.465	2.886	0	60	3,997
Mother's Education	1.557	2.719	0	13	3,997
Father's Education	2.914	3.863	0	13	3,997
Father's Employment (low-pay)	0.188	0.391	0	1	3,997
Water Level Measures: Respondents					
Water Level Deviation at Age 0	0.142	0.328	0	2.228	3,997
Water Level Deviation at Age 1	0.150	0.326	0	2.228	3,997
Water Level Deviation at Age 2	0.172	0.361	0	2.269	3,997
Water Level Deviation at Age 3	0.175	0.362	0	2.269	3,997
Water Level Deviation at Age 4	0.198	0.396	0	2.496	3,997
Water Level Deviation at Age 5	0.192	0.378	0	3.031	3,997
Water Level Measures: Siblings					
Water Level Deviation at Age 0	0.162	0.345	0	2.228	10,051
Water Level Deviation at Age 1	0.138	0.309	0	2.269	10,051
Water Level Deviation at Age 2	0.161	0.353	-0	2.269	10,051
Water Level Deviation at Age 3	0.167	0.348	0	3.031	10,051
Water Level Deviation at Age 4	0.209	0.405	0	3.031	10,051
Water Level Deviation at Age 5	0.162	0.338	0	3.031	10,051

Source: WiLCAS 2014, BWDB 1974-2000 and Authors Calculation.

Note: The flood count with credit variable denotes the number of flood shocks individuals have experienced within the ages of 0 to 5 in presence of access to credit of their mothers. The water level variable denotes the maximum water level of each year to be 1 standard deviation or more above the long run average maximum water level.

Table 4.2: **Access to Credit**

	Mean	Sd	Min	Max	N
Respondents					
Households with Credit Access at Age 0 of Respondents	0.163	0.369	0	1	3,997
Households with Credit Access at Age 1 of Respondents	0.188	0.391	0	1	3,997
Households with Credit Access at Age 2 of Respondents	0.215	0.411	0	1	3,997
Households with Credit Access at Age 3 of Respondents	0.240	0.427	0	1	3,997
Households with Credit Access at Age 4 of Respondents	0.263	0.441	0	1	3,997
Households with Credit Access at Age 5 of Respondents	0.288	0.453	0	1	3,997
Siblings					
Households with Credit Access at Age 0 of Siblings	0.320	0.466	0	1	10,051
Households with Credit Access at Age 1 of Siblings	0.318	0.466	0	1	10,051
Households with Credit Access at Age 2 of Siblings	0.300	0.458	0	1	10,051
Households with Credit Access at Age 3 of Siblings	0.314	0.464	0	1	10,051
Households with Credit Access at Age 4 of Siblings	0.261	0.439	0	1	10,051
Households with Credit Access at Age 5 of Siblings	0.289	0.454	0	1	10,051

Source: WiLCAS 2014, BRAC and Grameen Bank branch data and Authors Calculation

Note: The first section includes the sample of respondents only and households of the respondents with access to credit during the ages 0-5 of respondents. The last section includes the sample of only surviving siblings of the respondents and households of the surviving siblings with access to credit during the ages 0-5 of the siblings.

Table 4.3: **School Enrollment of Respondents and Female Sibling Survival: Logit Results**

	School Enrollment of Respondents	**Female Sibling Survival**
Flood Count without Access to Credit	-0.0370	0.0177
	(0.084)	(0.012)
Quartile		
Quartile 2	0.1722	-0.0072
	(0.138)	(0.018)
Quartile 3	-0.0520	-0.0075
	(0.134)	(0.019)
Quartile 4	-0.2797**	-0.0055
	(0.131)	(0.023)
Flood Count without Access to Credit x Quartile		
Flood Count without Access to Credit x Quartile 2	-0.0995	0.0157
	(0.128)	(0.018)
Flood Count without Access to Credit x Quartile 3	-0.0924	-0.0202
	(0.148)	(0.020)
Flood Count without Access to Credit x Quartile 4	0.0092	-0.0062
	(0.126)	(0.018)
Flood Count with Access to Credit	-0.1183	0.0190
	(0.122)	(0.015)
Flood Count with Access to Credit x Quartile		
Flood Count with Access to Credit x Quartile 2	-0.2354	-0.0179
	(0.178)	(0.023)
Flood Count with Access to Credit x Quartile 3	-0.1653	-0.0058
	(0.243)	(0.029)
Flood Count with Access to Credit x Quartile 4	0.0628	-0.0296
	(0.166)	(0.022)
Age	-0.4489***	-0.0085
	(0.093)	(0.008)
Age-squared	0.0047***	0.0001
	(0.002)	(0.000)
Mother's Education	0.1197***	-0.0008
	(0.016)	(0.002)
Father's Education	0.1135***	-0.0006
	(0.016)	(0.002)
Father's Occupation	-0.2855***	0.0271**
	(0.099)	(0.014)
Parental Landholdings	0.0804***	0.0039**
	(0.024)	(0.002)
Constant	9.8700***	0.6134***
	(1.4039)	(0.124)
N	3,997	10,051

Note: The table presents the estimated coefficients for probability of school enrollment of respondents by the age of 8 in presence of flood shock and probability of female sibling survival in presence of flood shock. School enrollment is a binary indicator set to one if the child had enrolled to school by the age of eight and zero otherwise. Female sibling survival is a binary indicator set to one if the probability of the sibling, conditional on being alive, is female and zero otherwise. The flood count without credit variable denotes the number of flood shocks individuals have experienced within the ages of 0 to 5 in absence of access to credit of their mothers. The flood count with credit variable denotes the number of flood shocks individuals have experienced within the ages of 0 to 5 in presence of access to credit of their mothers. The quartiles denote the average distance of the households to the four nearest flood stations. The higher the quartiles, the further the households are from the flood stations. The estimates include age and age-squared of individuals and parental characteristics of individuals (education, landholdings and father's occupation) as control variables. Father's occupation is a binary variable denoting if the father is employed in a low-pay occupation. District of birth fixed effects are included in the regressions. Standard errors given in parantheses are clustered at the household level. Statistical significance is denoted by p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.4: **Equality of Flood Count Coefficients**

	School Enrollment of Respondents	**Female Sibling Survival**
Flood Count without Access to Credit = Flood Count with Access to Credit	0.34	0.01
Flood Count without Access to Credit x Quartile 2 = Flood Count with Access to Credit x Quartile 2	0.43	0.01
Flood Count without Access to Credit x Quartile 3 = Flood Count with Access to Credit x Quartile 3	0.07	0.19
Flood Count without Access to Credit x Quartile 4 = Flood Count with Access to Credit x Quartile 4	0.08	0.81

Note: The table presents the estimates for joint test for equality of flood count with access to credit and flood count without access to credit for each distance quartile. Statistical significance is denoted by p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.8 Appendix for Chapter 4

4.8.1 The WiLCAS 2014

WiLCAS 2014 was carried out in two phases: phase 1 where 6293 women were individually interviewed and also asked detailed questions about all their siblings and phase 2 where a random sample of 1500 sisters were selected of the phase 1 respondents to be interviewed. In this chapter we use only phase 1 as the sibling module covers the information regarding all siblings including phase 3 sisters needed for the analysis. However, from the 6293 respondents we drop the respondents for whom we do not have the geo-referenced location of birth (we use sub-district geo-coordinates for the place of birth) giving us a final sample of 6113 respondents.

For the siblings, the survey has information on 26,960 siblings in total. However, we drop the siblings born before 1973 and after 1995 as we do not have flood water level level for those years reducing the sample by 9671. In addition, we also exclude the siblings for whom we not have the geo-referenced location of birth (same as respondents).

For girl child survival probability we need only surviving children. Hence from the 26960 siblings we include only the sample of siblings who were reported as being alive at the survey giving us a total of 14870 siblings.

4.8.2 Branch Location Data: BRAC and Grameen Bank

We collected the branch location data of all operating branches of the MFIs in Bangladesh in terms of district, upazila and union. For Grameen Bank that was the lowest administration classification available for the address of the branches. From the given classification, we have derived the geo-coordinates of the branches for this paper. We could not find the geo-coordinates for 25 branches of Grameen Bank, hence we dropped the branches from our analysis. For BRAC, the institution had the geo-coordinated address of all of its branches available. However, we use 2042 branches out of currently listed 2348 branches of BRAC as the insitution had merged/re-structured its branches during the late 1990s but the establishment dates were not available for those branches.

Chapter 5

Conclusion

Financial inclusion is advocated for bridging the poor without access to credit to the formal credit market. Over the past four decades, it has been established that the poor are capable of banking through the growing microfinance institutions around the world. The microfinance credit model came with a promise to alleviate poverty by providing small loans to women. Proponents claimed that providing access to credit to women would subsequently foster entrepreneurship, generate higher incomes, educate the children of borrowers, and lead to an upward spiral in socio-economic development. This hypothesis was solidifed by the set of pledges introduced by Grameen Bank to be followed by borrowers in Bangladesh to bring in a social change along with providing access to credit. However, recently several microfinance markets have faced instability and clients have increasingly experienced multiple borrowing, in some cases indebtedness, in various forms in different parts of the world (Taylor, 2011; Guerin et al., 2011; Mader, 2013; McIntos and Wydick, 2005; Schicks, 2014). This gave rise to a new literature which now provides concrete evidence for the short-run that access to microcredit has limited positive impact on the poor in developing countries (See Bauchet et al. (2011), Banerjee, Karlan and Zinman (2015) for a detailed summary).

In light of the emerging literature, the three chapters of this disseration investigate different angles of impact of microfinance on the poor households in a developing country setting. In the second chapter of this dissertation we study the long-term impact of access to credit of microfinance clients on the social outcomes of the next generation in Bangladesh. This chapter aims to add to the literature the long-term impact of microfinance which is yet to be explored by the RCTs. We investigate a range of outcomes of children when mothers have access to credit such as education, marriage and labour market outcomes. We focus particularly on female children and compare to the outcomes of male children as gender disparity prevails widely in developing countries in terms of access to secondary education and child marriage. We use a nationally representative household survey and branch location data of the two largest MFIs in Bangladesh to determine access to credit of first generation borrowers. We take advantage of an exogenous operational rule of MFIs in Bangladesh to seek and serve borrowers within a certain geographical distance. The discontinuity created by this rule gives rise to a quasi-experimental set-up which allows us to use spatial regression discontinuity design (RDD) to estimate effect of access to credit. To determine access to credit of mothers we map the location of birth of children at the union level with the location of microfinance operating branches of the MFIs. We classify control and treatment groups according to the distance of being located within or beyond the 4-kilometer operating radius of at least MFI branch. The two MFIs considered in this chapter have the same cut-off for the operational rule. In this chapter, the control group is taken as the households with no access to MFI branches and the treatment group is taken as the households with access to at least one MFI branch.

We examine outcomes of children in their adult life such as completed years of schooling, age at marriage and labour market outcomes. We find limited evidence of positive impact of access to credit in the long-run. We estimate educational attainment decreases along with a decline in age at marriage for both sons and daughters. This could be due to two potential reasons. Firstly, existing studies find that credit access of mothers increases nutrition allocation of children leading to better child health and parents are more likely to use healthy children to substitute for adult labour in productive activities carried out by the household (Filmer et al., 1998; Duflo, 2003; Buchmann et al., 2017). As a result, school attendance could decline. Secondly, Field and Ambrus (2008) provides evidence that early marriage leads to lower education. Thus, our results do not indicate a positive impact of access to microfinance in the long run for the social outcomes of the next generation. This indicates that MFIs need to re-formulate the pledges advocated to the borrowers. In addition to the existing pledges, it might be useful to add a pledge that the borrowers would not employ their children in the productive activities financed by the loans taken from the MFIs.

In the third chapter, we investigate a concern which has recently surfaced in the literature. The literature documents that recent exponential expansion of microfinance resulted in an increase in competition. This has led to multiple borrowing among borrowers in many microfinance sectors among the developing countries. Given the heightened competition among the MFIs globally and growing discussion on risk of over-indebtedness of clients in the microfinance sector, the third chapter in this thesis empirically estimates the impact of multiple sources of credit on borrowing and monthly income of borrowers. We investigate if an additional source of credit in terms of an additional bank branch can potentially affect debt of borrowers and subsequently impact their pyschosocial wellbeing. The hypothesis of the study is multiple branches might elevate the risk of over-indebtedness among borrowers due to multiple borrowing and lead to a subsequent loss in pyscho-social wellbeing. The borrowing outcomes that we look at include amount of outstanding loans, number of outstanding loans, amount of delinquent loans and number of delinquent loans. We use the household survey used in the earlier chapter and the three largest MFIs in Bangladesh. The choice of MFIs was based on the fact that 70% of the MFI loans taken by the survey respondents were from these three MFIs: ASA, BRAC and Grameen Bank. In this chapter, we add the third largest MFI, ASA, in addition to the two studied in chapter 2 (and later in chapter 4). This is because ASA expanded their branch network in the late 1990s and respondents of the survey studied in this disseration had already crossed their school-going age by then.

We use the same exogenous operational rule of MFIs for our identification strategy for spatial RDD. The only difference in operation of ASA is that it has a cut-off of 5 km radius to seek and serve borrowers. We calculate the running variable of access to credit according to the respective servicing thresholds of the MFIs. We classify the control and treatment groups based on the distance of households and the servicing threshold of the MFI branches. In this chapter, the control group is taken as the households with access to one MFI branch and the treatment group is taken as the households with access to two MFI branches. Furthermore, we study if debt has an subsquent impact on psychosocial wellbeing of borrowers in terms of life, health and financial satisfaction and overall happiness.

We find that access to an additional source of credit lowers outstanding debt both in amounts and number. This could have two explanations. First, the additional souce of credit allows borrowers to repay the existing loans. A number of studies suggest that women take multiple loans for consumption purposes, pressure of giving away the loans to other family members and self-control problems (Karim, 2011; Krishnaswamy, 2007; Shicks, 2013; Laibson, 1997; Fudenberg and Levine, 2006). Second, the borrowers take up multiple loans to accumulate sufficient captial for undertaking larger investments (Field et al., 2012). In addition, we find no effect on monthly income of borrowers. However, the outstanding debt has no subsequent effect on psychosocial wellbeing of borrowers. Our results are partially in line with Angelucci, Karlan and Zinman (2013) where the authors found no effect of loans on life satisfaction and economic status. This implies that access to multiple sources has a positve effect on borrowers as it allows borrowers to lower their debt level. Furthermore, amidst the growing concern among policymakers regarding over-indebtedness of MFI clients, the results of our study indicate that increased debt is not necessarily detrimental to borrower welfare. We find no impact of increased debt on psychosocial indicators of borrowers. It is particularly interesting to observe that lower debt has no impact on psychosocial wellbeing of borrowers.

In the fourth chapter, we examine the impact of floods on early life outcomes of children and test for prevalence of gender disparity in child mortality in Bangladesh. We extend our analysis by introducing credit access as the existing literature suggests that exposure to flood shocks in the absence of credit access leads to the most severe effect on child health and their subsequent early-life outcomes (Foster, 1995; Rashid, 1999; Rose, 1999). We calculate deviation from historical average river water level using the spatial and temporal variation in water levels recorded at the flood stations in Bangladesh. We take a count of number of floods children had experienced within the period of study when their mothers did not have access to credit. We take the same count when their mothers had access to credit to incorporate credit access in our analysis. To measure the extent of flooding of the households we spatially match the households to the flood stations to calculate the distance between them. Based on the nearest distance, we divide our sample into quartiles. In our analysis, we do not find any effect of flooding on the early-life outcomes of children. We do not detect any gender disparity in child mortality in our sample. Furthermore, access to credit did not seem to affect how floods impact upon early life outcomes. This indicates that alternative measures of the flood shock might reveal a stronger link between flooding and early life outcomes. Flood events can be mapped in several ways and the literature is yet to conform on a method to do so. We use a standard measure used for rainfall shock to compute our flood shock.

We acknowledge the limitations in the analysis of the three chapters. In order to locate the respondents of the survey and the microfinance bank branches we spatially map them with respect to the unions of birth of respondents to the union of bank branches. However, we could not match approximately 1352 unions of birth of respondents which is why we had to exclude them from our study. Furthermore, while geo-referencing the MFI branches for this dissertation we could not locate approximately 25 branches of Grameen Bank and 38 branches of ASA. This is because the MFIs had no record of the union where the branches were established. Hence, we exclude those branches too. However, given that the missing branches account for less than 1% of the total number of branches, it is unlikely to overturn the results presented in the chapters.

Access to credit is advocated by the international development agencies as one of the most effective tools to combat poverty. The chapters in this thesis provide evidence on impact of access to credit on outcomes of women for both short and long run. The results of the first chapter indicate that giving poor households a path to borrow might not be the magic-bullet for poverty alleviation as promised by the microfinance model. We add to the literature by providing evidence for the long term impact of provision of credit to the poor in a developing country supporting the existing evidence for the short run. Corroborating with the RCTs, we find limited evidence of positive impact of microfinance. The findings show that loans to poor do not necessarily translate into better socio-economic outcomes for the children. On the contrary, we find access to credit to lower secondary education for children and increase the probablity of child marriage. For future line of research, it might be intersting to add child labour as labour market outcome to investigate if reduced secondary schooling increases in prevalence of child labour. Given the recent debate on impact of access to credit and concerns regarding over-indebtedness among microfinance clients, results of the third chapter in this dissertation show that multiple sources of credit lowers debt of borrowers however has no impact on borrower welfare in terms of their psychosocial wellbeing. Then we look at impact of access to credit in presence of natural calamity, floods in our case, on early life outcomes of children of borrowers. We further test if access to credit has an effect on gender disparity in mortality of children in presence of flood shocks. We find no effect on either of the outcomes studied in the chapter. This again points towards a weak impact of access to credit. However, the results of the study might not pick up an effect as the exisiting literature suggests people might have built an extent of resilience due to recurrent floods. It might be interesting to add other early-life outcomes such as cognitive development as well as health outcomes such as weight and height of children.

The findings of this dissertation have policy implications on access to credit among poor households in developing countries. Financial inclusion is advocated by most developing agencies leading to extensive funding for the microfinance sector. However, our findings suggest that investing heavily in microfinance in order to expand the coverage of the formal financial services to the poor might not be the one-stop solution to growth and development. A more comprehensive approach is probably needed to address the issues faced by developing countries. This thesis sheds light on the need to develop the sector incorporating the needs of the poor to translate into growth and development of developing countries. The sector, amidst the exponential growth, perhaps could make the existence of credit bureau mandatory to oversee if the borrowers are making poor borrowing choices in presence of self-control problems. Credit bureaus would also help to control excessive competition among MFIs and allow information symmetry. Furthermore, MFIs could also alter the sensitivity training of the programme. A pledge of not engaging in child labour could be essential for the credit model to stop the channel where access to credit leads to adolescent children dropping out of secondary school. There is a pressing need for a more comprehensive change in the microcredit model for poverty eradication and fostering growth and prosperity.

Bibliography

Adams, D. W. and Pischke, J. V. (1992). Microenterprise credit programs: Deja vu. *World Development*, 20(10):1463–1470.

Afridi, F. (2010). Women's empowerment and the goal of parity between the sexes in schooling in india. *Population studies*, 64(2):131–145.

Afridi, F., Mukhopadhyay, A., and Sahoo, S. (2012). Female labour force participation and child education in india: the effect of the national rural employment guarantee scheme.

Afroze, T., Rahman, S., and Yousuf, S. (2014). Multiple borrowing through microcredit and its impact on loan repayment: Study in bangladesh. *Research Journal of Finance and Accounting*, 5(21):107–119.

Aguilar, A. and Vicarelli, M. (2011). El nino and mexican children: medium-term effects of early-life weather shocks on cognitive and health outcomes. *Cambridge, United States: Harvard University, Department of Economics.Manuscript*.

Ahmed, S. M., Chowdhury, M., and Bhuiya, A. (2001). Micro-credit and emotional well-being: experience of poor rural women from matlab, bangladesh. *World Development*, 29(11):1957–1966.

Al-Shami, S. S. A., Majid, I. B. A., Rashid, N. A., and Hamid, M. S. R. B. A. (2014). Conceptual framework: The role of microfinance on the wellbeing of poor people cases studies from malaysia and yemen. *Asian Social Science*, 10(1):230.

Alderman, H., Hoddinott, J., and Kinsey, B. (2006). Long term consequences of early childhood malnutrition. *Oxford economic papers*, 58(3):450–474.

Allen, J., Balfour, R., Bell, R., and Marmot, M. (2014). Social determinants of mental health. *International review of psychiatry*, 26(4):392–407.

Almond, D. (2006). Is the 1918 influenza pandemic over? long-term effects of in utero influenza exposure in the post-1940 us population. *Journal of political Economy*, 114(4):672–712.

Amar, M., Ariely, D., Ayal, S., Cryder, C. E., and Rick, S. I. (2011). Winning the battle but losing the war: The psychology of debt management. *Journal of Marketing Research*, 48(SPL):S38–S50.

Amirapu, A., Asadullah, M. N., and Wahhaj, Z. (2018). *Marriage, work and migration: The role of infrastructure development and gender norms.*

Anderson, S. and Baland, J.-M. (2002). The economics of roscas and intrahousehold resource allocation. *Quarterly Journal of Economics*, pages 963–995.

Anyanwu, J. C. and Erhijakpor, A. E. (2009). Health expenditures and health outcomes in africa. *African Development Review*, 21(2):400–433.

Armendáriz, B. and Morduch, J. (2010). *The economics of microfinance.* MIT press.

Asadullah, M. N. and Chaudhury, N. (2009). Reverse gender gap in schooling in bangladesh: insights from urban and rural households. *Journal of Development Studies*, 45(8):1360–1380.

Asadullah, M. N. and Wahhaj, Z. (2018). Early marriage, social networks and the transmission of norms. *Economica.*

Attanasio, O., Augsburg, B., Haas, R. D., Fitzsimons, E., and Harmgart, H. (2015). The impacts of microfinance: Evidence from joint-liability lending in mongolia. *American Economic Journal: Applied Economics*, 7(1):90–122.

Augsburg, B., Haas, R. D., Harmgart, H., and Meghir, C. (2015). The impacts of microcredit: Evidence from bosnia and herzegovina. *American Economic Journal: Applied Economics*, 7(1):183–203.

Bandiera, O., Buehren, N., Burgess, R., Goldstein, M., Gulesci, S., Rasul, I., and Sulaiman, M. (2018). *Women's empowerment in action: evidence from a randomized control trial in Africa.* World Bank.

Banerjee, A., Chandrasekhar, A. G., Duflo, E., and Jackson, M. O. (2013). The diffusion of microfinance. *Science (New York, N.Y.)*, 341(6144):1236498.

Banerjee, A., Duflo, E., Glennerster, R., and Kinnan, C. (2015a). The miracle of microfinance? evidence from a randomized evaluation. *American Economic Journal: Applied Economics*, 7(1):22–53.

Banerjee, A., Karlan, D., and Zinman, J. (2015b). Six randomized evaluations of microcredit: Introduction and further steps. *American Economic Journal: Applied Economics*, 7(1):1–21.

Banerjee, A. V. and Duflo, E. (2007). The economic lives of the poor. *Journal of economic perspectives*, 21(1):141–168.

Barnes, C., Keogh, E., and Nemarundwe, N. (2001). Microfinance program clients and impact: An assessment of zambuko trust, zimbabwe. *Washington, DC: AIMS*.

Basu, S. (1997). The conservatism principle and the asymmetric timeliness of earnings 1. *Journal of Accounting and Economics*, 24(1):3–37.

Bateman, M. and Chang, H.-J. (2012). Microfinance and the illusion of development: From hubris to nemesis in thirty years.

Bauer, M., Chytilová, J., and Morduch, J. (2012). Behavioral foundations of microcredit: Experimental and survey evidence from rural india. *The American Economic Review*, 102(2):1118–1139.

Beegle, K., Dehejia, R. H., and Gatti, R. (2006). Child labor and agricultural shocks. *Journal of Development Economics*, 81(1):80–96.

Behrman, J. R. (1988). Intrahousehold allocation of nutrients in rural india: Are boys favored? do parents exhibit inequality aversion? *Oxford Economic Papers*, 40(1):32–54.

Behrman, J. R. and Deolalikar, A. B. (1988). Health and nutrition. *Handbook of development economics*, 1:631–711.

Behrman, J. R. and Rosenzweig, M. R. (2002). Does increasing women's schooling raise the schooling of the next generation? *American Economic Review*, 92(1):323–334.

Berg, P. and Frost, A. (2005). Dignity at work for low wage, low skill service workers. *Relations Industrielles/Industrial Relations*, 60(4):657–682.

Bernheim, B. D., Ray, D., and Yeltekin, S. (2012). Poverty and self-control.

Black, S. E. (1999a). Do better schools matter? parental valuation of elementary education. *The Quarterly Journal of Economics*, 114(2):577–599.

Black, S. E. (1999b). Do better schools matter? parental valuation of elementary education. *The Quarterly Journal of Economics*, 114(2):577–599.

Bloch, F. and Rao, V. (2002). Terror as a bargaining instrument: A case study of dowry violence in rural india. *American Economic Review*, 92(4):1029–1043.

Bloch, F., Rao, V., and Desai, S. (2004). Wedding celebrations as conspicuous consumption signaling social status in rural india. *Journal of Human Resources*, 39(3):675–695.

Bloom, S. S., Wypij, D., and Gupta, M. D. (2001). Dimensions of women's autonomy and the influence on maternal health care utilization in a north indian city. *Demography*, 38(1):67–78.

Boiwa, W. and Bwisa, H. (2014). Effects of multiple borrowing on the living standards of microfinance clients at kenya women finance trust. *Trans Nzoia Region.Developing Country Studies*, 4(9):77–85.

Brammer, H. (1990). Floods in bangladesh: Ii. flood mitigation and environmental aspects. *Geographical Journal*, pages 158–165.

Brau, J. C. and Woller, G. M. (2004). Microfinance: A comprehensive review of the existing literature. *The Journal of Entrepreneurial Finance*, 9(1):1–28.

Braun, B. and Aßheuer, T. (2011). Floods in megacity environments: vulnerability and coping strategies of slum dwellers in dhaka/bangladesh. *Natural hazards*, 58(2):771–787.

Brouwer, R., Akter, S., Brander, L., and Haque, E. (2007). Socioeconomic vulnerability and adaptation to environmental risk: a case study of climate change and flooding in bangladesh. *Risk Analysis: An International Journal*, 27(2):313–326.

Bruce, M. L., Takeuchi, D. T., and Leaf, P. J. (1991). Poverty and psychiatric status: longitudinal evidence from the new haven epidemiologic catchment area study. *Archives of General Psychiatry*, 48(5):470–474.

Buchmann, N., Field, E., Glennerster, R., Nazneen, S., Pimkina, S., and Sen, I. (2017). Power vs money: Alternative approaches to reducing child marriage in bangladesh, a randomized control trial. *Unpublished Manuscript*.

Burgess, R. and Pande, R. (2005). Do rural banks matter? evidence from the indian social banking experiment. *American Economic Review*, 95(3):780–795.

Caldwell, J. C. (1993a). Health transition: the cultural, social and behavioural determinants of health in the third world. *Social science and medicine*, 36(2):125–135.

Caldwell, J. C. (1993b). Health transition: the cultural, social and behavioural determinants of health in the third world. *Social science and medicine*, 36(2):125–135.

Caldwell, J. C. (1994). How is greater maternal education translated into lower child mortality? *Health transition review*, 4(2):224–229.

Calonico, S., Cattaneo, M., and Titiunik, R. (2014a). Package 'rdrobust': Robust data-driven statistical inference in regression-discontinuity designs (version 0.70); 2014. *Software available at: http://cran.r-project.org/web/packages/rdrobust/index.html (accessed 11.11.15).*

Calonico, S., Cattaneo, M. D., Farrell, M. H., and Titiunik, R. (2017). rdrobust: Software for regression-discontinuity designs. *The Stata Journal*, 17(2):372–404.

Calonico, S., Cattaneo, M. D., and Titiunik, R. (2014b). Robust data-driven inference in the regression-discontinuity design. *The Stata Journal*, 14(4):909–946.

Carroll, C. D., Overland, J., and Weil, D. N. (2000). Saving and growth with habit formation. *American Economic Review*, pages 341–355.

Chakravarty, S., Iqbal, S. Z., and Shahriar, A. Z. M. (2013). Are women "naturally" better credit risks in microcredit? evidence from field experiments in patriarchal and matrilineal societies in bangladesh. In *Annual Meeting of the American Economic Association in Philadelphia.*

Charitonenko, S., Campion, A., and Fernando, N. A. (2004). Commercialization of microfinance perspectives from south and southeast asia.

Charness, G. and Gneezy, U. (2009). Incentives to exercise. *Econometrica*, 77(3):909–931.

Chaudhury, I. and Matin, I. (2002). Dimensions and dynamics of microfinance membership overlap–a micro study from bangladesh. *Small Enterprise Development*, 13(2):46–55.

Chen, G., Rasmussen, S., Reille, X., and Rozas, D. (2010). Indian microfinance goes public: The sks initial public offering. *Focus Note*, 65.

Chowdhury, A. M. R., Nath, S. R., and Choudhury, R. K. (2002). Enrolment at primary level: Gender difference disappears in bangladesh. *International Journal of Educational Development*, 22(2):191–203.

Crépon, B., Devoto, F., Duflo, E., and Pariente, W. (2011). *Impact of microcredit in rural areas of Morocco: Evidence from a Randomized Evaluation.*

Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: the indirect role of parental expectations and the home environment. *Journal of family psychology*, 19(2):294.

de Aghion, B. A. and Morduch, J. (2005a). The economics of microfinance mit press. *Cambridge, Massachusetts.*

de Aghion, B. A. and Morduch, J. (2005b). The economics of microfinance mit press. *Cambridge, Massachusetts.*

Dercon, S. and Krishnan, P. (2000). In sickness and in health: Risk sharing within households in rural ethiopia. *Journal of political Economy*, 108(4):688–727.

Desai, S. and Alva, S. (1998). Maternal education and child health: Is there a strong causal relationship? *Demography*, 35(1):71–81.

D'espallier, B., Guerin, I., and Mersland, R. (2011). Women and repayment in microfinance: A global analysis. *World Development*, 39(5):758–772.

Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic literature*, 50(4):1051–1079.

Dupas, P. and Robinson, J. (2013). *Daily needs, income targets and labor supply: evidence from Kenya.*

Duvendack, M. (2011). What is the evidence of the impact of microfinance on the well-being of poor people?

Ermisch, J. and Pronzato, C. (2010). *Causal effects of parents' education on children's education.*

Fafchamps, M. and Lund, S. (2003). Risk-sharing networks in rural philippines. *Journal of Development Economics*, 71(2):261–287.

Fafchamps, M., Udry, C., and Czukas, K. (1998). Drought and saving in west africa: are livestock a buffer stock? *Journal of Development Economics*, 55(2):273–305.

Feigenberg, B., Field, E., and Pande, R. (2013). The economic returns to social interaction: Experimental evidence from microfinance. *The Review of Economic Studies*, 80(4):1459–1483.

Fernald, L. C., Gertler, P. J., and Neufeld, L. M. (2008). Role of cash in conditional cash transfer programmes for child health, growth, and development: an analysis of mexico's oportunidades. *The Lancet*, 371(9615):828–837.

Field, E. and Ambrus, A. (2008). Early marriage, age of menarche, and female schooling attainment in bangladesh. *Journal of political Economy*, 116(5):881–930.

Field, E., Hollander, A. J., and Pande, R. (2014). Micro finance: Points of promise.

Field, E., Pande, R., Papp, J., and Park, Y. J. (2012). Repayment flexibility can reduce financial stress: a randomized control trial with microfinance clients in india. *PloS one*, 7(9):e45679.

Field, E., Pande, R., Papp, J., and Rigol, N. (2013). Does the classic microfinance model discourage entrepreneurship among the poor? experimental evidence from india. *The American Economic Review*, 103(6):2196–2226.

Fikree, F. F. and Pasha, O. (2004). Role of gender in health disparity: the south asian context. *BMJ (Clinical research ed.)*, 328(7443):823–826.

Filmer, D. (2004). Determinants of health and education outcomes. *Background note for the WDR*.

Filmer, D. and King, E. (1999). *Gender disparity in South Asia: comparisons between and within countries*. The World Bank.

Fischer, G. and Ghatak, M. (2010). Repayment frequency in microfinance contracts with present-biased borrowers.

Flug, K., Spilimbergo, A., and Wachtenheim, E. (1998). Investment in education: do economic volatility and credit constraints matter? *Journal of Development Economics*, 55(2):465–481.

Foster, A. D. (1995). Prices, credit markets and child growth in low-income rural areas. *The Economic Journal*, 105(430):551–570.

Fudenberg, D. and Levine, D. K. (2006). A dual-self model of impulse control. *American economic review*, 96(5):1449–1476.

Fuhrer, J. C. (2000). Habit formation in consumption and its implications for monetary-policy models. *American Economic Review*, pages 367–390.

George, L. K. (1981). Subjective well-being: Conceptual and methodological issues. *Annual review of gerontology and geriatrics*, 2(1):345–382.

George, S. M. (1997). Female infanticide in tamil nadu, india: from recognition back to denial? *Reproductive health matters*, 5(10):124–132.

Ghatak, M. (1999). Group lending, local information and peer selection. *Journal of Development Economics*, 60(1):27–50.

Ghatak, M. and Guinnane, T. W. (1999). The economics of lending with joint liability: theory and practice. *Journal of Development Economics*, 60(1):195–228.

Guarcello, L., Mealli, F., and Rosati, F. C. (2010). Household vulnerability and child labor: the effect of shocks, credit rationing, and insurance. *Journal of population economics*, 23(1):169–198.

Guariglia, A. and Rossi, M. (2002). Consumption, habit formation, and precautionary saving: evidence from the british household panel survey. *Oxford Economic Papers*, 54(1):1–19.

Gugerty, M. K. (2007). You can't save alone: Commitment in rotating savings and credit associations in kenya. *Economic Development and cultural change*, 55(2):251–282.

Guha, B. and Chowdhury, P. R. (2013). Micro-finance competition: Motivated micro-lenders, double-dipping and default. *Journal of Development Economics*, 105:86–102.

Gupta, M. D. (1987). Selective discrimination against female children in rural punjab, india. *Population and development review*, 13(1):77–100.

Haque, C. E. and Zaman, M. Q. (1993). Human responses to riverine hazards in bangladesh: a proposal for sustainable floodplain development. *World Development*, 21(1):93–107.

Hobcraft, J. (1993). Women's education, child welfare and child survival: a review of the evidence.

Hoddinott, J. (2006). Shocks and their consequences across and within households in rural zimbabwe. *The Journal of Development Studies*, 42(2):301–321.

Hossain, M. (1988). *Credit for alleviation of rural poverty: The Grameen Bank in Bangladesh*, volume 65. Intl Food Policy Res Inst.

Hossain, M. B., Phillips, J. F., and Pence, B. (2007). The effect of women's status on infant and child mortality in four rural areas of bangladesh. *Journal of Biosocial Science*, 39(3):355–366.

Hurdus, A. R. (1988). Outlook for the 1988/89 aman crop and early projections for the 1988/89 wheat and boro crops. *meitorandum, Office of Food and Agriculture, USAID Bangladesh*, 18.

Imbens, G. W. and Lemieux, T. (2008). Regression discontinuity designs: A guide to practice. *Journal of Econometrics*, 142(2):615–635.

Islam, K. M. M. and Asadullah, M. N. (2018). Gender stereotypes and education: A comparative content analysis of malaysian, indonesian, pakistani and bangladeshi school textbooks. *PloS one*, 13(1):e0190807.

Jacob, B. A. and Lefgren, L. (2004). Remedial education and student achievement: A regression-discontinuity analysis. *The review of economics and statistics*, 86(1):226–244.

Jacoby, H. G. and Skoufias, E. (1997). Risk, financial markets, and human capital in a developing country. *The Review of Economic Studies*, 64(3):311–335.

Johnson, S. (2004). The impact of microfinance institutions in local financial markets: a case study from kenya. *Journal of International Development*, 16(3):501–517.

Kabeer, N. (2005). Is microfinance a'magic bullet'for women's empowerment? analysis of findings from south asia. *Economic and Political weekly*, pages 4709–4718.

Karim, L. (2011). *Microfinance and its discontents: Women in debt in Bangladesh.* U of Minnesota Press.

Karlan, D. and Zinman, J. (2011). Microcredit in theory and practice: using randomized credit scoring for impact evaluation. *Science (New York, N.Y.)*, 332(6035):1278–1284.

Kazianga, H. and Udry, C. (2006). Consumption smoothing? livestock, insurance and drought in rural burkina faso. *Journal of Development Economics*, 79(2):413–446.

Khan, J. R. and Awan, N. (2017). A comprehensive analysis on child mortality and its determinants in bangladesh using frailty models. *Archives of Public Health*, 75(1):58.

Khandker, S. R. (2005). Microfinance and poverty: Evidence using panel data from bangladesh. *The World Bank Economic Review*, 19(2):263–286.

Khandker, S. R. (2007). Coping with flood: role of institutions in bangladesh. *Agricultural Economics*, 36(2):169–180.

Khandker, S. R. and Samad, H. A. (2013). *Microfinance growth and poverty reduction in Bangladesh: What does the longitudinal data say?*, volume 16. Institute of Microfinance Dhaka.

Khandker, S. R. and Samad, H. A. (2014). *Dynamic effects of microcredit in Bangladesh*. The World Bank.

Krishnaswamy, K. (2007). Competition and multiple borrowing in the indian microfinance sector. *Center for Microfinance, IFMR, Chennai.Working Paper*.

Laibson, D. (1997). Golden eggs and hyperbolic discounting. *The Quarterly Journal of Economics*, pages 443–477.

Lee, D. S. (2008). Randomized experiments from non-random selection in us house elections. *Journal of Econometrics*, 142(2):675–697.

Lee, D. S. and Card, D. (2008). Regression discontinuity inference with specification error. *Journal of Econometrics*, 142(2):655–674.

LeVine, R., LeVine, S., and Schnell, B. (2001). " improve the women": Mass schooling, female literacy, and worldwide social change. *Harvard Educational Review*, 71(1):1–51.

Lusardi, A., Schneider, D. J., and Tufano, P. (2011). *Financially fragile households: Evidence and implications.*

Maccini, S. and Yang, D. (2009). Under the weather: Health, schooling, and economic consequences of early-life rainfall. *American Economic Review*, 99(3):1006–1026.

Mader, P. (2013). Rise and fall of microfinance in india: The andhra pradesh crisis in perspective. *Strategic Change*, 22(1-2):47–66.

Magadi, M. A., Madise, N. J., and Rodrigues, R. N. (2000). Frequency and timing of antenatal care in kenya: explaining the variations between women of different communities. *Social science and medicine*, 51(4):551–561.

Mahmud, S. (2003). Female secondary school stipend programme in bangladesh: A critical assessment. *Dhaka, BIDS.*

Malapit, H. J. L., Sraboni, E., Quisumbing, A. R., and Ahmed, A. U. (2019). Intrahousehold empowerment gaps in agriculture and children's wellbeing in bangladesh. *Development Policy Review*, 37(2):176–203.

Malhotra, A., Warner, A., McGonagle, A., and Lee-Rife, S. (2011). Solutions to end child marriage: what the evidence shows.

Marchetta, F., Sahn, D. E., and Tiberti, L. (2018). School or work?: The role of weather shocks in madagascar.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, 142(2):698–714.

McIntosh, C. (2008). Estimating treatment effects from spatial policy experiments: an application to ugandan microfinance. *The review of economics and statistics*, 90(1):15–28.

McIntosh, C., Janvry, A. D., and Sadoulet, E. (2005). How rising competition among microfinance institutions affects incumbent lenders. *The Economic Journal*, 115(506):987–1004.

McIntosh, C. and Wydick, B. (2005). Competition and microfinance. *Journal of Development Economics*, 78(2):271–298.

Miller, B. D. (2001). Female-selective abortion in asia: Patterns, policies, and debates. *American anthropologist*, 103(4):1083–1095.

Morduch, J. (1995). Income smoothing and consumption smoothing. *Journal of economic perspectives*, 9(3):103–114.

Morduch, J. (1998). *Does microfinance really help the poor?: New evidence from flagship programs in Bangladesh.* Research Program in Development Studies, Woodrow School of Public and International Affairs.

Morduch, J. (1999). The microfinance promise. *Journal of economic literature*, 37(4):1569–1614.

Morduch, J. and Armendariz, B. (2005). *The economics of microfinance.* mit Press.

Morvant-Roux, S., Guérin, I., Roesch, M., and Moisseron, J.-Y. (2014). Adding value to randomization with qualitative analysis: the case of microcredit in rural morocco. *World Development*, 56:302–312.

Mosley, P. and Hulme, D. (1998). Microenterprise finance: is there a conflict between growth and poverty alleviation? *World Development*, 26(5):783–790.

Mpogole, H., Mwaungulu, I., Mlasu, S., and Lubawa, G. (2012). Multiple borrowing and loan repayment: A study of microfinance clients at iringa, tanzania. *Global Journal of Management and Business Research*, 12(4):68.

Mullainathan, S. and Krishnan, S. (2008). Psychology and economics: What it means for microfinance. *Financial Access Initiative Concept Note.*

Murthy, R. K., Raju, K., and Kamath, A. (2005). Towards women's empowerment and poverty reduction: Lessons from the andhra pradesh south asia poverty alleviation programme. *Micro-credit, poverty and empowerment: Linking the triad*, 61.

Nguyen, M. C. and Wodon, Q. (2014). Impact of child marriage on literacy and education attainment in africa. *Washington, DC: UNICEF and UNESCO Statistics.*

Ninno, C. D., Dorosh, P. A., and Smith, L. C. (2003). Public policy, markets and household coping strategies in bangladesh: Avoiding a food security crisis following the 1998 floods. *World Development*, 31(7):1221–1238.

Ninno, C. D. and Lundberg, M. (2005). Treading water: the long-term impact of the 1998 flood on nutrition in bangladesh. *Economics and Human Biology*, 3(1):67–96.

O'Donoghue, T. and Rabin, M. (1999). Doing it now or later. *American Economic Review*, pages 103–124.

Ogbu, J. U. (1987). Variability in minority school performance: A problem in search of an explanation. *Anthropology and Education Quarterly*, 18(4):312–334.

Ozier, O. (2016). The impact of secondary schooling in kenya: A regression discontinuity analysis. *Journal of Human Resources*.

Parsons, J., Edmeades, J., Kes, A., Petroni, S., Sexton, M., and Wodon, Q. (2015). Economic impacts of child marriage: a review of the literature. *The Review of Faith and International Affairs*, 13(3):12–22.

Paxson, C. and Schady, N. (2007). Cognitive development among young children in ecuador the roles of wealth, health, and parenting. *Journal of Human resources*, 42(1):49–84.

Paxton, J. (2003). A poverty outreach index and its application to microfinance. *Economics Bulletin*, 9(2):1–10.

Pebley, A. R., Goldman, N., and Rodriguez, G. (1996). Prenatal and delivery care and childhood immunization in guatemala: Do family and community matter? *Demography*, 33(2):231–247.

Pettersson-Lidbom, P. (2008). Do parties matter for economic outcomes? a regression discontinuity approach. *Journal of the European Economic Association*, 6(5):1037–1056.

Pitt, M. M. and Khandker, S. R. (1998). The impact of group-based credit programs on poor households in bangladesh: Does the gender of participants matter? *Journal of political economy*, 106(5):958–996.

Pitt, M. M., Khandker, S. R., and Cartwright, J. (2006). Empowering women with micro finance: Evidence from bangladesh. *Economic Development and Cultural Change*, 54(4):791–831.

Pollak, R. A. (1970). Habit formation and dynamic demand functions. *Journal of political Economy*, 78(4, Part 1):745–763.

Quisumbing, A. R. and Maluccio, J. A. (2003). Resources at marriage and intrahousehold allocation: Evidence from bangladesh, ethiopia, indonesia, and south africa. *Oxford Bulletin of Economics and Statistics*, 65(3):283–327.

Rahman, M. W., Luo, J., Ahmed, S., and Xiaolin, W. (2012). The synthesis of grameen bank, brac and asa microfinance approaches in bangladesh. *World Applied Sciences Journal*, 20(7):1055–1062.

Rasheed, K. S. (2008). *Bangladesh: Resource and environmental profile*. AH Development Publishing House.

Ravallion, M. and Lokshin, M. (1999). *Subjective economic welfare*. The World Bank.

Ravichandran, D. (2016). Multiple borrowing and loan repayment: A study of microfinance clients in the trincomalee district.

Rhyne, E. (2001). *Mainstreaming microfinance: How lending to the poor began, grew, and came of age in Bolivia*. Number 332.1 R4. Kumarian Press Bloomfield, CT.

Robinson, M. (2001). *The microfinance revolution: Sustainable finance for the poor*. World Bank Publications.

Roodman, D. and Morduch, J. (2014). The impact of microcredit on the poor in bangladesh: Revisiting the evidence. *Journal of Development Studies*, 50(4):583–604.

Rose, E. (1999). Consumption smoothing and excess female mortality in rural india. *Review of Economics and statistics*, 81(1):41–49.

Rosenzweig, M. R. and Wolpin, K. I. (1980). Testing the quantity-quality fertility model: The use of twins as a natural experiment. *Econometrica: journal of the Econometric Society*, pages 227–240.

Rosenzweig, M. R. and Wolpin, K. I. (2000). Natural natural experiments in economics. *Journal of Economic Literature*, 38(4):827–874.

Sastry, N. (1996). Community characteristics, individual and household attributes, and child survival in brazil. *Demography*, 33(2):211–229.

Schicks, J. (2010). Microfinance over-indebtedness: Understanding its drivers and challenging the common myths. *Centre Emile Bernheim (CEB) Working Paper*, 10:047.

Schicks, J. (2011). Over-indebtedness of microborrowers in ghana: An empirical study from a customer protection perspective. *Center for Financial Inclusion Publication*, 15.

Schuler, S. R., Hashemi, S. M., and Riley, A. P. (1997). The influence of women's changing roles and status in bangladesh's fertility transition: evidence from a study of credit programs and contraceptive use. *World Development*, 25(4):563–575.

Sen, A. (1990). More than 100 million women are missing. *The New York Review of Books*, 37(20):61–66.

Sen, A. (1995). Gender inequality and theories of justice. *Women, culture and development: A study of human capabilities*, pages 259–273.

Sen, A. (2001). The many faces of gender inequality. *New republic*, pages 35–39.

Shahid, S. (2012). Vulnerability of the power sector of bangladesh to climate change and extreme weather events. *Regional Environmental Change*, 12(3):595–606.

Sharma, D. C. (2003). Widespread concern over india's missing girls. selective abortion and female infanticide cause girl-to-boy ratios to plummet. *Lancet (London, England)*, 362(9395):1553–6736(03)14780–0.

Strauss, J. and Thomas, D. (1995). Human resources: Empirical modeling of household and family decisions. *Handbook of development economics*, 3:1883–2023.

Tarozzi, A., Desai, J., and Johnson, K. (2015). The impacts of microcredit: Evidence from ethiopia. *American Economic Journal: Applied Economics*, 7(1):54–89.

Taylor, M. (2011). 'freedom from poverty is not for free': rural development and the microfinance crisis in andhra pradesh, india. *Journal of Agrarian Change*, 11(4):484–504.

Verplanken, B. and Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy and Marketing*, 25(1):90–103.

Vogelgesang, U. (2003). Microfinance in times of crisis: The effects of competition, rising indebtedness, and economic crisis on repayment behavior. *World Development*, 31(12):2085–2114.

Vogelstein, R. B. (2013). *Ending child marriage: How elevating the status of girls advances US foreign policy objectives*. Council on Foreign Relations.

Vogl, T. S. (2013). Marriage institutions and sibling competition: Evidence from south asia. *The Quarterly journal of economics*, 128(3):1017–1072.

Weich, S. and Lewis, G. (1998). Poverty, unemployment, and common mental disorders: population based cohort study. *BMJ (Clinical research ed.)*, 317(7151):115–119.

Younus, M. A. F. (2010). *Community-based autonomous adaptation and vulnerability to extreme floods in Bangladesh: processes, assessment and failure effects.*

Yunus, M. (1994). Banking on the poor. *Dhaka: Grameen Bank*.

Yunus, M. (1999). The grameen bank. *Scientific American*, 281(5):114–119.

Yunus, M. (2009). *Creating a world without poverty: Social business and the future of capitalism*. Public Affairs.

Zeller, M. and Meyer, R. L. (2002). Improving the performance of microfinance: Financial sustainability, outreach and impact. *The Triangle of Microfinance, Baltimore, Maryland*, 2002:1–18.

Zimmermann, L. (2018). Remember when it rained-schooling responses to shocks in india.