EMPOWERING WOMEN THROUGH MICROFINANCE IN DJIBOUTI

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Abstract:

This study explores the effect of microfinance practices on the empowerment of Djiboutian women using 692 borrower and non-borrower households based in the six major urban centres of Djibouti. We construct a composite indicator of empowerment that measures women's control over various aspects of their lives and their environment, such as participation in household decisions, control over income, ownership of property, and exposure to media and health care. The index is then used in three dimensions: economic, social and interpersonal. Estimates are made using an empirical strategy based on instrumental variables and a number of econometric techniques. Our results show an important link between microcredit and women's empowerment. Whether or not households have taken out loans shows a significant relationship with the three dimensions of empowerment. This is also true for the number of loans that households received. The results are robust regardless of the specifications and econometric techniques used. The important and significant relationship of microfinance found in the study adds to the growing literature glorifying the effectiveness of microfinance as a tool for women's empowerment.

Keywords: Women's empowerment; microfinance; instrumental variable; Djibouti.
JEL Classification: I3; C8; O1

1. Introduction

'Women's empowerment has been one of the top priorities of development agencies and governments around the world and it has been identified that even in developed

countries, women continue to suffer various forms of discrimination in one way or another. women in developing countries suffer from gender inequalities.

One of the reasons for the persistence of these inequalities lies in the gender norms that subject women in developing countries (Agarwal, 1994; Sullivan, 1994). In addition, patriarchy and traditional cultures in Africa give more resources and power to men, resulting in women's lack of access to education, health and labour markets. For example, agricultural diversification in Kenya has led to greater male involvement in agriculture, which has eroded women's control over income-generating production and thus their relative power within the household (Dolan, 2001). Women's empowerment in the development process has so far been seen as achieving a "better deal" for women, with the main focus being on women's well-being (Sen, 2000).

The concept of microfinance through its main component, microcredit, remains an influential tool for income generation, human resource development, poverty reduction and women's empowerment (Kessey 2005). It is very difficult to find a society without poverty, even in developed countries. Access to credit can be an important tool for the poor to safeguard their food security. Traditional banks and other financial institutions fail to address the difficulties of the poor in general and of women in particular.

In recent decades, the debate on the impact of microcredit on women's autonomy remains controversial and divides many development economists. However, evidence of the effectiveness of microfinance as a measure of women's empowerment in developing countries remains mixed. At the other end of the spectrum, studies have argued that microfinance empowers women, as measured by indicators such as access to consumption, health care, improved decision-making power, increased spatial mobility, access to property and reduced domestic violence (Pitt and Khandker 1996; Hashemiet al. 1996), while randomized studies yield negligible results (Banerjee &Duflo 2011). On the other 'other side of the coin', other studies have highlighted a number of negative consequences, both within households and on a larger scale, such as men's control over women's loans and/or businesses (Montgomery et al. 1996, Garikipati 2008; Goetz and Gupta 1996; Rahman 1999), an increase in domestic violence and patriarchal domination through the control of loan officers (D'Espallier et al. 2011; Rahman 1999), increased responsibilities, workload and fatigue among women (Akerly 1995), the disparate treatment of men and women in lending conditions (Agier and Szafarz 2010) and the exacerbation of inequalities between women (Guérin and Palier 2005; Mayoux 2001; Pattenden 2010; Rankin 2002; Rao 2008, Wright 2006).

This study aims to provide evidence on the relationship between microfinance and women's empowerment in Djibouti. In Djibouti, women are more affected by extreme and relative poverty and more affected by inactivity compared to men (National Gender Policy 2011-2021). They are also more numerous in the informal sector and their activities are more precarious. This is due to women's limited access to financing (from banks and microfinance institutions), which is mainly due to the lack of bankable projects, the inexistence of financial accounts and the difficulty of providing sufficient guarantees. However, in response to these challenges, the government has decided to adopt a ten-year National Gender Policy (2011-2021) in order to consolidate its commitment to gender equity and equality in all economic and social areas.

Our study focuses on the survey conducted in 2015 among 2060 households based in Djibouti's six major urban centres. However, we limit our sample to the 692 women

households that may or may not have benefited from microcredit from microfinance institutions. The study contributes to the literature in several ways:

First, we investigate whether participation in the microfinance program helps to empower women by improving their economic, social and interpersonal status. To do so, we created a composite indicator of women empowerment[1] using three dimensions of autonomy: economic, social and interpersonal. Thus, the impact of microfinance on women's autonomy is analyzed in several dimensions: the impact of the acquisition of microcredit by households, the number of loans contracted with microfinance institutions and the duration since the acquisition of the loan.

Second, a number of empirical strategies are employed to deal with problems of selection bias.

The microfinance indicator is instrumented using information on women's membership in a savings and credit cooperative. Although obtaining a microcredit is compulsory, membership is free, widely acquired and open to a broad segment of society, such as households (poor and rich), small businesses and associations. Almost two thirds (58 per cent) of women members of credit unions eventually obtain microcredit. In addition, our estimates are made using propensity score matching (PSM), inverse probability weighting (IPW) and augmented inverse probability weighting (AIPW). The results of the study are robust regardless of the specifications and econometric techniques used. We found an important link between the credits received by women and their degree of autonomy. Whether or not the household took out a loan shows a significant relationship with our dependent variable, which is women's autonomy. This result is also true for the number of loans that households received. The beneficial and significant impact of microfinance found in the study is in addition to the growing literature glorifying the effectiveness of microfinance as a tool for women's autonomy.

The next section of the paper presents a brief review of the literature on microfinance and women's empowerment and then on the microfinance sector and the status of women in Djibouti in section 3. Section 4 presents the data and methodology used. The results are presented and discussed in section 5. Robustness measures are described in section 6. The final section concludes and proposes policy recommendations.

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2. Literature review

Al-Mamun et al. (2014) provides a comprehensive survey on the microfinance and women empowerment literature, which can define women empowerment in several

[1] Empowerment is a process that can be defined as the expansion of people's capacity to make strategic life choices in a context where this capacity was previously denied" (Kabeer, 2000). Its main components are resources, perceptions, relationships and power (Marty, 1992). Our composite empowerment indicator measures women's control over various aspects of their lives and environment, such as participation in household decisions, control over income, ownership of property, and exposure to the media and their health.

dimensions, including women's role in household economic decision, women's economic security, women's control over resources, women's control over family decision, women's mobility, women's legal awareness, and a drawing conclusion is that there is no consensus on the topic. 'The impact of microcredit on women's empowerment remains controversial, as documented in the microfinance literature. While some studies claim that microcredit helps women increase their income earning abilities, leading to greater power to overcome cultural asymmetries, others contend that small loans allocated to women are usually controlled by their spouses, which results in more severe subordination of women and leaves them more vulnerable to the patriarchy system within the household and/or at society level' (Li, Gan and Hu 2011, 239). Naila Kabeer (2001) argued that explores the reasons why recent evaluations of the empowerment potential of credit programs for rural women in Bangladesh have arrived at very conflicting conclusions.

On the one side, rising access to microfinance may result in higher women empowerment. Using fieldwork conducted in the Aoral district of Cambodia in April 2008, Chhay (2011) found this positive relationship. It is in accord with many other studies, see for example Marguerite Berger (1989), Naved, R. (1994), Hashemi, S., Schuler, S. and Riley, I. (1996), Sajeda Amin and Anne R. Pebley (1999), Naila Kabeer (2001), Pitt, M., Khandker, S. and Cartwright, J. (2003). Al-Mamun et al. (2014) argues that "participation in AIM's microcredit program generated positive and significant impact on women's empowerment in Urban." Using the data from a special survey carried out in rural Bangladesh in 1998-99, it is found that 'women's participation in micro-credit programs helps to increase women's empowerment. Credit program participation leads to women taking a greater role in household decision-making, having greater access to financial and economic resources, having greater social networks, having greater bargaining power compared with their husbands, and having greater freedom of mobility' (Pitt, Khandker and Cartwright 2003).

On the other side, if microfinance is linked to the bad practice of high interest rate, non-productive loan, over-indebtedness, landless and migration, its effect is associated with the worse outcome on women empowerment (Chhorn 2018). Using both qualitative and quantitative methods Interview, Goetz, M. A. and R. S. Gupta (1996) suggested that a preoccupation with "credit performance" - measured primarily in terms of high repayment rates - affects the incentives of fieldworkers dispensing and recovering credit, in ways which may outweigh concerns to ensure that women develop meaningful control over their investment activities. Fiona Leach and Shashikala Sitaram (2002) explain descriptively that the impact that the project had on their economic and social status over a period of time and highlights the negative consequences of excluding male relatives from playing any meaningful role. It suggests ways in which the project might have been made more male inclusive while still empowering women. At the same time, it acknowledges that even if the men's hostility to the project had been overcome, the women's micro enterprises were unlikely to have been viable commercially. This is because the project insisted that the women operate as a group in what was a high-risk area of economic activity, with no clear strategy as to how their work could be sustained. Supriya Garikipati (2008), using the Two-stage estimation procedure and Logit estimation, showed that Impact evaluation studies routinely find that lending to women benefits their households. However, a number of them also find that this may not empower the women concerned. Loans procured by women are often diverted into enhancing household's assets and incomes. This combined with woman's lack of co-ownership of family's

productive assets, we conclude, results in her disempowerment. If empowering women is a crucial objective, then the patriarchal hold on productive assets must be challenged. The most recent study in Bangladesh, using Propensity score matching technique, by Arijita Dutta, and Sharmistha Banerjee (2018) argued that Easy access to credit through MF initiatives could not inculcate the psychological potential to bear risk and bricolage among the borrowers. Self-employment in micro enterprises, without much innovation and risk taking, has been the characteristics of overall income generating process of the model.

It is also worth noting also that the relationship between microfinance and women empowerment also come from the inverse direction, which gender drives microfinance. For example, the study of women in microfinance institutions of Bert D'espallier, Isabelle Guerin & Roy Mersland (2013). Using panel dataset of 398 MFIs operating in 73 countries worldwide from 2001 to 2010 and applying Ordinary Least Square (OLS) and logit analyses, the study finds that a focus on women is associated with group-lending methods, international orientation, smaller loans, and non-commercial legal status. We find that a focus on women significantly improves repayment but does not enhance overall financial performance because of higher relative costs. Moreover, the higher relative costs do not stem from servicing women per se but from the smaller loans offered to women and the group-lending methodology practised by MFIs focusing on women.

AUTHORS	DATA	METHODS	FINDING
Marguerite Berger. 1989. Giving women credit: The strengths and limitations of credit as a tool for alleviating poverty. World Development Volume 17, Issue 7, July 1989, Pages 1017-1032.	Not specific.	Descriptive	Three channels ((bank schemes, intermediary programs, parallel programs, or poverty-focused development banks) have been more effective than the first (minimalist / credit plus) in improving women's access to credit.
Naved, R. (1994). Empowerment of Women: Listening to the Voices of Women, The Bangladesh Development Studies, 'Special Issue on Women, Development and Change'22(2): 121-155	A focused ethnographic study. The qualitative data were combined with the quantitative data from a population based longitudinal data set that covers the period from 1986 to 1993. This data set includes	Key Informant Interviews, Focus Group Discussions (FGD) and Open-ended Interviews.	Women hold that many important and positive changes took place at individual, familial and societal levels. They feel that they have gained greater access and control over resources. Further, the relationship of women with others have improved. To a lesser extent, they have become able to change the external environment.

	demographic, socioeconomic and programme participation indicators collected during a thorough Household Survey carried out in 1986 and updated regularly for all vital events.		
Goetz, M. A. and R. S. Gupta (1996). 'Who takes the credit? Gender, power, and control over loan use in rural credit programs in Bangladesh', World Development 24 (1): 45-63	Qualitative studies of 275 loans (22 of these to men) across four organizations: BRAC (106 loans to women; 22 to men), Grameen Bank (53), TMSS (39), and RD-12 (55). compiling detailed loan use histories on the basis of discussions with borrowers.	Qualitative and Quantitative methods Interview.	The paper finds that a preoccupation with "credit performance" - measured primarily in terms of high repayment rates - affects the incentives of fieldworkers dispensing and recovering credit, in ways which may outweigh concerns to ensure that women develop meaningful control over their investment activities.
Hashemi, S., Schuler, S. and Riley, I. (1996). Rural Credit Programs Women's Empowerment in Bangladesh, World Development, Volume 24, Issue 4, April 1996, Pages 635-653.	Cross-section data. Ethnographic research was undertaken in six villages during 1991-94 to document processes of change both in women's roles and status and in norms related to reproduction.	The logistic regression models Empowerment indicators: mobility, economic security, ability to make small purchases, ability to make larger purchases, involvement in major household decisions, relative freedom from domination within the family, political and legal awareness, and involvement in political campaigning and protests.	This analysis, however, suggests that involvement in credit programs does empower women. Participation in Grameen Bank and BRAC increases women's mobility, their ability to make purchases and major household decisions, their ownership of productive assets, their legal and political awareness and participation in public campaigns and protests.

Sajeda Amin and Anne R. Pebley (1999). **Gender Inequality within Households: The Impact of a Women's Development Programme in 36 Bangladeshi Villages**, The Bangladesh Development Studies, Vol. 22, No. 2/3, WOMEN, DEVELOPMENT AND CHANGE (June-Sept. 1994), pp. 121-154 (34 pages).	Five hundred female respondents were interviewed in 36 rural villages in two thanas of anikganj district in 1989.	An experimental design. Multiple logistic regression. Women empowerment: control over household resources, mobility and autonomy and attitudes and aspirations.	"BRAC (Bangladesh Rural Advancement Committee) membership positively affected a woman's decision making role, their control over resources and mobility but less so on their attitudes regarding marriage and education of their daughters."
Naila Kabeer. 2001. Conflicts Over Credit: Re-Evaluating the Empowerment Potential of Loans to Women in Rural Bangladesh. World Development Volume 29, Issue 1, January 2001, Pages 63-84.		Literature and discussion.	Mix results. This paper explores the reasons why recent evaluations of the empowerment potential of credit programs for rural women in Bangladesh have arrived at very conflicting conclusions.
Fiona Leach and Shashikala Sitaram. 2002. Microfinance and Women's Empowerment: A Lesson from India. Development in Practice, Vol. 12, No. 5 (Nov., 2002), pp. 575-588	Twenty women in each of the four countries participated in the research. This article focuses only on the Indian project, located in Karnataka State in South India.	Descriptive	The impact that the project had on their economic and social status over a period of time and highlights the negative consequences of excluding male relatives from playing any meaningful role. It suggests ways in which the project might have been made more male inclusive while still empowering women. At the same time, it acknowledges that even if the men's hostility to the project had been overcome, the women's micro enterprises were unlikely to have been viable commercially. This is because the project insisted that the women operate as a group in what was a high-risk area of economic activity,

			with no clear strategy as to how their work could be sustained.
Pitt, M., Khandker, S. and Cartwright, J. (2003). Does Micro-Credit Empower Women? Evidence from Bangladesh, World Bank Policy Research Working Paper 2998. Washington D.C.	Cross-section data. Rural Bangladesh in 1998-99	This paper estimates the impact of participation in micro-credit programs on a large set of qualitative responses to questions that characterize women's autonomy and gender relations within the household.	women's participation in micro-credit programs helps to increase women's empowerment. Credit program participation leads to women taking a greater role in household decisionmaking, having greater access to financial and economic resources, having greater social networks, having greater bargaining power compared with their husbands, and having greater freedom of mobility. Female credit also tended to increase spousal communication in general about family planning and parenting concerns. The effects of male credit on women's empowerment were, at best, neutral, and at worse, decidedly negative. Male credit had a negative effect on several arenas of women's empowerment, including physical mobility, access to savings and economic resources, and power to manage some household transactions.
SupriyaGarikipati. 2008. The Impact of Lending to Women on Household Vulnerability and Women's Empowerment: Evidence from India. World Development. Volume 36, Issue 12, December 2008,	Cross-section	Two-stage estimation procedure. Logit estimation. Empowerment indicators: Ownership of household assets and incomes (ASSETS);	Impact evaluation studies routinely find that lending to women benefits their households. However, a number of them also find that this may not empower the women concerned. Loans

Pages 2620-2642		Control over minor finances (MINFIN); Control over major finances (MAJFIN); Say in household decisions (DECISIONS); Work time allocation (WORKTIME); Division of domestic chores (CHORES); Composite empowerment (EMPOWER)	procured by women are often diverted into enhancing household's assets and incomes. This combined with woman's lack of co-ownership of family's productive assets, we conclude, results in her disempowerment. If empowering women is a crucial objective, then the patriarchal hold on productive assets must be challenged.
Women's economic empowerment through microfinance in Cambodia Author(s): Daraka Chhay Source: Development in Practice, Vol. 21, No. 8 (November 2011), pp. 1122-1137	Fieldwork was conducted in the Aoral district in April 2008.	The use of the Village Bank and interviews	that female members see their improved economic conditions directly related to the involvement in the microfinance programme
Bert D'espallier , Isabelle Guerin & Roy Mersland (2013) Focus on Women in Microfinance Institutions, The Journal of Development Studies, 49:5, 589-608, DOI: 10.1080/00220388.2012.720364	Panel data Financial and general data for this study were collected from 398 MFIs operating in 73 countries worldwide, 2001–2010	Ordinary Least Square (OLS) and logit analyses	Based on a global dataset, the results indicate that a focus on women is associated with group-lending methods, international orientation, smaller loans, and non-commercial legal status. We find that a focus on women significantly improves repayment but does not enhance overall financial performance because of higher relative costs. Moreover, the higher relative costs do not stem from servicing women per se but from the smaller loans offered to women and the group-lending methodology practised by MFIs focusing on women.
Abdullah Al-Mamun, Sazali Abdul Wahab, Mohammad	This study utilized a cross-	Women Empowerment:	The main goal of this study was to assess the

Nurul Huda Mazumder and Zhan Su, Empirical Investigation on the impact of Microcredit on Women Empowerment in Urban Peninsular Malaysia, The Journal of Developing Areas, Vol. 48, No. 2 (Spring 2014), pp. 287-306.	sectional using stratified random sample in 2008	Women's role in household economic decision; Women's economic security; Women's control over resources; Women's control over family decision; Women's mobility; Women's legal awareness	impact of participation in Amanah Ikhtiar (AIM) microcredit program on the empowerment among urban low-income women in Malaysia. => Participation in AIM's microcredit program generated positive and significant impact on women's empowerment in Urban.
Sofia Karina Trommlerová, Stephan Klasen, Ortrud Leßmann. 2015. Determinants of Empowerment in a Capability-Based Poverty Approach: Evidence from The Gambia, World Development Volume 66, February 2015, Pages 1-15.	Cross-section 2008.	Generalized ordered logit model, OLS, and 2SLS. Probit model Using household-level information and advanced econometric techniques that also address endogeneity issues. Four types of power and empowerment: Empowerment as control: control over personal decisions; Empowerment as choice: domain-specific autonomy, household decision-making; Empowerment in community: changing aspects in one's life at communal level; Empowerment as change: changing aspects in one's life at individual level.	Age, gender, marital status, nationality, economic activity, and health are important determinants of empowerment at both communal and individual levels.
Arijita Dutta, and Sharmistha Banerjee. 2018. Does microfinance impede sustainable entrepreneurial initiatives among women borrowers? Evidence from	Cross-section in Bangladesh	Propensity score matching technique	Easy access to credit through MF initiatives could not inculcate the psychological potential to bear risk and bricolage among the borrowers.

rural Bangladesh. Journal of Rural Studies Volume 60, May 2018, Pages 70-81.			Self-employment in micro enterprises, without much innovation and risk taking, has been the characteristics of overall income generating process of the model.

3. Microfinance and Women's Role in Djibouti's Society

3.1. Women's Role in Djibouti's Society

a) Status of women in Djibouti

Women are more affected by extreme and relative poverty and more touched by inactivity compared to men. The feminization of poverty is due to the fact that women are disadvantaged in education, access to economic opportunities, employment and property ownership (National Gender Policy 2011-2021). They are more numerous in the informal sector and in more precarious sectors of activity. However, the informal sector is the main provider of employment, especially in urban areas, but with one of the greatest gender disparities and inequalities. Women are more numerous in this sector (31.7%) where they carry out various commercial activities (sale of khat, from vegetables and fruit to electronic products and foreign exchange (EDESIC[2], 2015). This situation translates into women's more limited access to accounts in financial institutions and, consequently, to bank credits and micro-financing. The main reasons for women's limited access to financing from banks and microfinance institutions are the lack of bankable projects, the absence of financial accounts and the difficulty of providing sufficient guarantees, which also means that male family members lack encouragement in an increasingly patriarchal and patrilineal society that gives men a dominant social position in the family and the community and makes women subordinate to men; limited spatial mobility and lack of social capital in Djibouti (Ministry of Women and the Family of the Government of Djibouti, 2019).

In 2017, women's participation in the labour force was 32% compared to 49% for men. Moreover, women suffer much more from unemployment than men. 63% of women are unemployed compared to 38% of men. In addition, the literacy rate is higher among men (63%), with a difference of 20 points compared to that of women (43%) (EDAM4-IS[3], Djibouti National Statistical Institute, 2017).

According to the study on the evolution of the situation of women in Djibouti 2000-2018 (Ministry of Women and the Family, 2019), in terms of access to health, women acknowledge that their health status has improved. Nevertheless, they have raised many dysfunctions with regard to health services: payment for care and medicines are obstacles for poor households, and there is a lack of midwives and gynaecologists. In addition, the active participation of rural women in Djibouti is hampered by limited labour force participation, immobility, income disparity and lack of decision-making opportunities. Another indicator of the situation of women in Djibouti is violence against women, which is a major problem in the region and is also of concern in Djibouti.

b) Politicies concerning the empowerment of women in Djibouti

The Djiboutian government is following the Millennium Development Goals (MDGs). With regard to the empowerment of women, education policies, in particular "universal primary education",

[2] Djibouti Survey on Employment, the Informal Sector and Household Consumption (EDESIC).
[3] Djibouti Household Survey on Social Indicators (EDAM4-IS).

"promotion of gender equality" and "improvement of maternal health" are important. Therefore, government policies have been striving to achieve these goals by 2015 (Ministry of Women and Family, 2019). Despite the creation of a Ministry of Women and the Family and the fact that much progress[4] has been made, however, no MDG has been achieved by 2015, hence the importance of continuing and even redoubling the efforts already made.

Other policies aimed at strengthening women's empowerment are of paramount importance and will aim to diversify women's economic domains, facilitating their access to drinking water and energy in rural areas, but also supporting them in terms of resources and assets (capital and land production techniques, market and transport) hence the promotion of women's entrepreneurship (National Gender Policy 2011-2021).

3.2. Microfinance in Djibouti[5]

In order to combat poverty, the government has enshrined the development of microfinance as a key axis in the Strategic Framework for the Fight against Poverty (named in french, Cadre Stratégique de Lutte contre la pauvreté (CSLP)) initiated in 2004. Three years later, the National Initiative for Social Development (INDS) reaffirmed microfinance as a privileged instrument for poverty reduction. The aim of the public authorities was to eventually structure an efficient network of local microfinance institutions covering the entire territory and capable of providing financial and non-financial services adapted to the needs of the most disadvantaged.

Efforts to popularize microcredit services have had a significant impact in the capital (Djibouti) and the interior regions. This situation is explained by the increase in the number of people who have joined and benefited from the microcredit system. (See figure 1).

Nevertheless, in relation to the amount of credits served, we note that solidarity groups were able to benefit from 975.4 million FD of credits (44.6%) and 1210.2 million FD (55.4%) for individual members. As for women, they are the most represented with nearly 70% and obtained an amount of 527.5 million FD of credits to finance their activities. (See Figure 2).

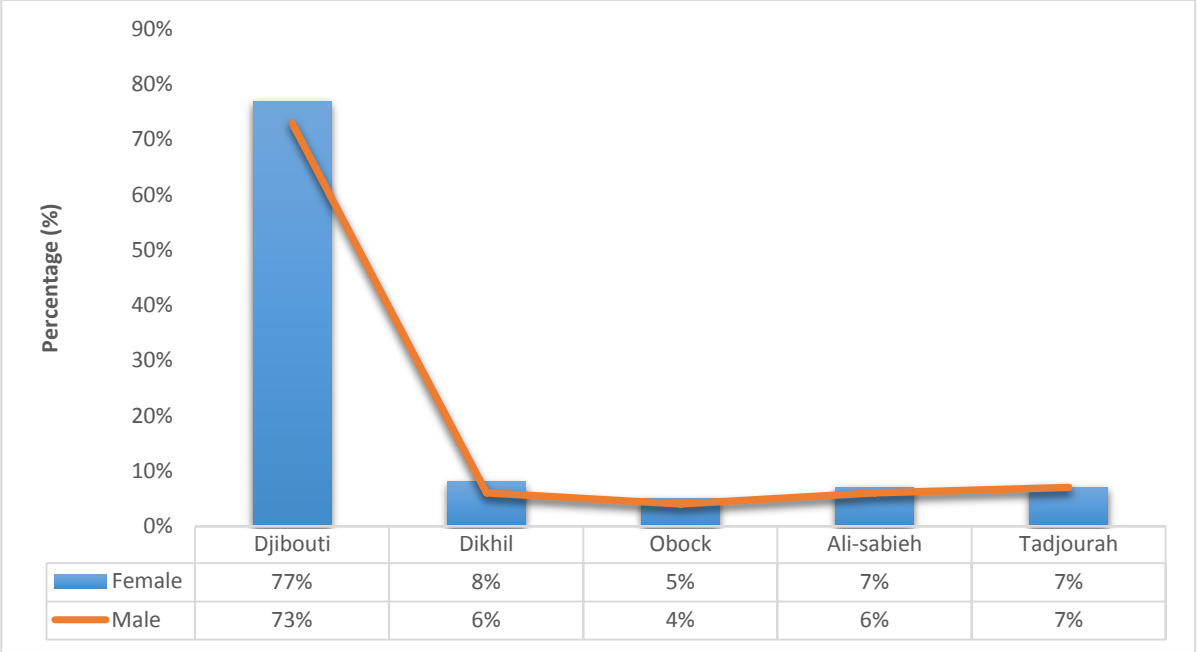
Figure 1 & 2

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[4] A significant increase in the literacy of women aged 15-24, effective integration into the decision-making sphere and a significant drop in mortality rates.

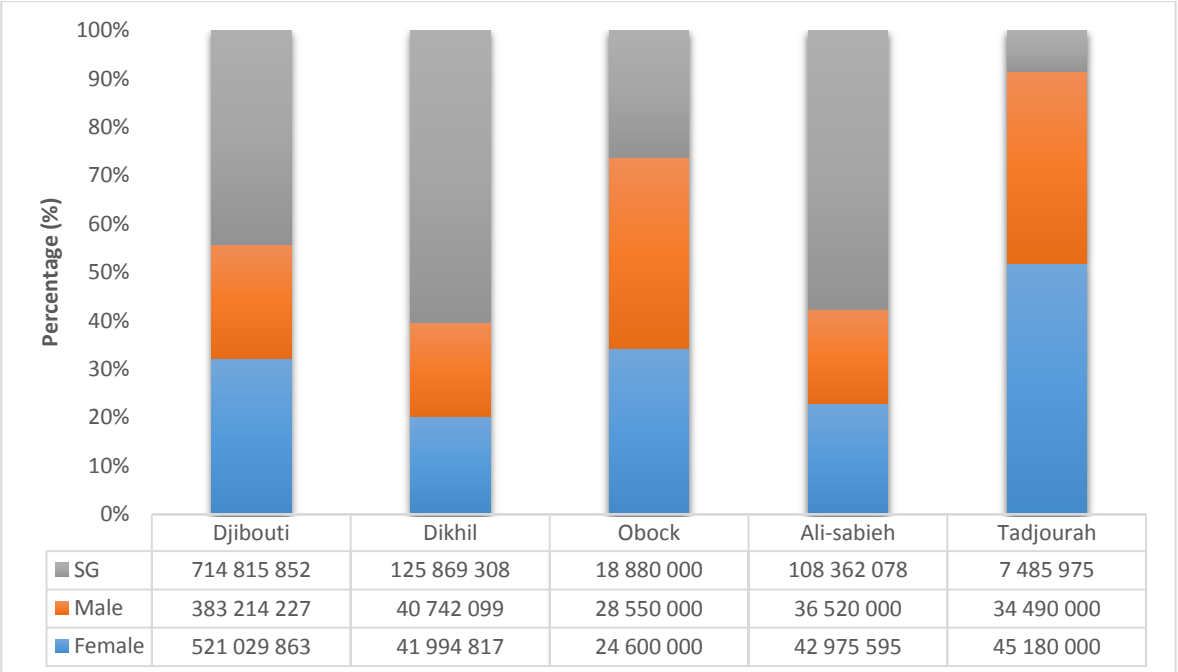
[5] For a detailed on Microfinance in Djibouti, see Ali and Mughal (2019).

Figure 1: Evolution of CPEC (Credit Unions) members by region at the end of 2016



Source: Djibouti Social Development Agency (ADDS, 2015).

Figure 2: Cumulative credits granted between 2011-2016 (in Djibouti francs)



Source: Djibouti Social Development Agency (ADDS, 2015).

4. EMPIRICAL METHODOLOGY

4.1. Data

Our analysis is based on the survey of the 2015 Djibouti Urban Poverty Reduction Project (PREPUD). This survey, is conducted by the Djiboutian Agency for Development

(ADDS) and the Department of Statistics and Demographic Studies (DISED), covers the capital, Djibouti City, and the five regional capitals, Arta, Ali-Sabieh, Dikhil, Obock and Tadjourah. In addition, the survey contains a wide range of information on education, employment, access to basic social services and microfinance, covering a total of 2060 households. However, we limit our sample to the 692 women who may or not have benefited from microcredit from microfinance institutions (women who answered "Yes or No" to the question "Is at least one member of the household a beneficiary of a microcredit? »).

4.2. Variable description

Dependent variable

We construct a composite indicator of women empowerment that measures women's control over various aspects of their lives and environment, such as participation in household decisions, control over income, asset ownership, media exposure, and their health. The indicators that make up the index are listed in Table A1 in the appendix. Based on these indicators, women are grouped into two categories: (i) autonomous and (ii) non-autonomous. The index is then used in three dimensions: economic, social and interpersonal.

Women empowerment

Women in self-governing categories have the capacity to make important decisions such as buying or selling land, repairing houses or participating in and strengthening income-generating activities. In addition, they are also able to exercise their right to control and benefit from resources while improving their economic status and well-being.

Overall, we have a high concentration of women's autonomy in the regions of Tadjourah and Arta. 52.5% and 51.5% of the women surveyed have better autonomy than those in other regions. Moreover, 43% of the women surveyed from the capital Djibouti City had a favourable level of autonomy. At the other end of the spectrum, women from the southern regions (Ali-sabieh and Dikhil) had higher rates of autonomy, at 41 and 40 per cent respectively. Finally, the women surveyed from the Obock region are far from being autonomous.

In Tadjourah, 52.5% of the women surveyed enjoy greater autonomy than in other regions. This high rate of autonomy recorded by women in this region is not insignificant but is due to a historical fact that has been strongly recognized and accepted in society for a long time. The social organisation known as "fiqma"[6] ensures freedom and autonomy that allows them to participate in social events. This has led to these women becoming more emancipated in the opportunities offered by the public authorities by setting up microfinance institutions that provide for the needs of the most destitute through the granting of credit.

[6] Afar term meaning an organization of age groups in women play a crucial role. This organization is not new but has existed for a long time. Their objective is to help women take their "destiny in hand" while promoting their initiative such as crafts, entrepreneurship and all other opportunities that allow them to participate more in social events.

51.5% of the women surveyed in the Arta region enjoy an advantageous degree of autonomy, which can be explained by the fact that the city's proximity to the capital (Djibouti City) encourages them to invest in activities such as catering and the sale of khat[7], which remains minimal compared to other regions, although it is nevertheless present. This high rate of empowerment is explained by the better skills of women, who also participate in household decisions.

43% of the women surveyed in Djibouti-City capital are self-sufficient. Most of the women in the capital are "charcharis"[8] who supply the markets of Djibouti with various goods from neighbouring countries and the Gulf. They are also khat sellers, manual money-changers, and sellers of doughnuts, sweets and clothing. Most of their activities are facilitated by the microcredit funds of which they are the main beneficiaries.

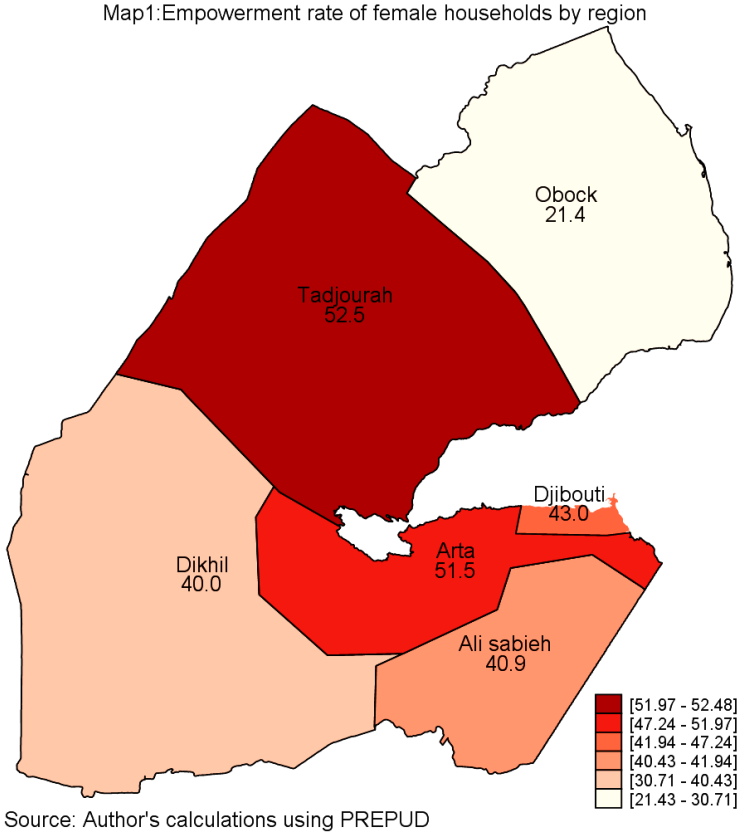
Women in the southern regions (Dikhil and Ali-sabieh) have emancipation rates of around 40% and 41% respectively behind Tadjourah and Arta. Although these two regions remain landlocked, they are heavily dependent on road traffic from Ethiopia. The two regions in question are also experiencing a strong flow of immigration from neighbouring countries (Somalia and Ethiopia) accompanied by a strong urbanization of the population. In the south of the country, women are more numerous in trading activities, especially in khat and non-khat details.

Finally, 21% of the women surveyed in the Obock region are far from being autonomous. This is primarily due to the fact that not all of them are educated to participate in women's activist organizations, which leads to a lack of awareness and information. Although these women have access to institutional sources of credit, the use of the loans taken out are not for productive purposes but rather for consumption or to meet primary needs.

[7] Khat is a plant that is widely consumed by the people and heads of states in the Horn of Africa (Djibouti, Somalia and Somaliland), where the leaves are chewed and provide stimulant effects to its followers. In the European Union khat is considered a narcotic drug. Ethiopia and Kenya are the two major khat growers in the region.

[8] Shopkeepers in the Somali language.

Map1:Empowerment rate of female households by region



Source: Author's calculations using PREPUD

Following the concept adopted by Kabeer(2001), we also consider three dimensions of autonomy at the economic, social and interpersonal levels.

Economic Autonomy

Economic Autonomy is the ability of women to participate in and benefit from growth processes in a way that recognizes the value of their contributions, respects their dignity and enables them to negotiate a more equitable distribution of the benefits of growth. Economic autonomy increases women's access to economic resources and opportunities, including jobs, financial services, property and other productive assets, skills development and market information. However, a woman also needs confidence and social skills to translate options into practical action.

Social empowerment

The concept of social autonomy is closely linked to women's access to public spaces and mobility in the community. In order to develop and maintain their position in a community, women must be able to engage socially - for example by participating in community meetings and events, and by forming their own networks. This will improve their social trust, their access to public information and their ability to influence social norms, which will ultimately bring a strategic advantage to society (Kabeer, 2001).

Interpersonal empowerment

Interpersonal autonomy is a process of internal change, which focuses on a woman's sense of belief in her own decision-making abilities. For example, attitudes and

perceptions reflect internal transformation and empower women (Kabeer, Mahmud and Tasneem, 2011).

Variables of interest

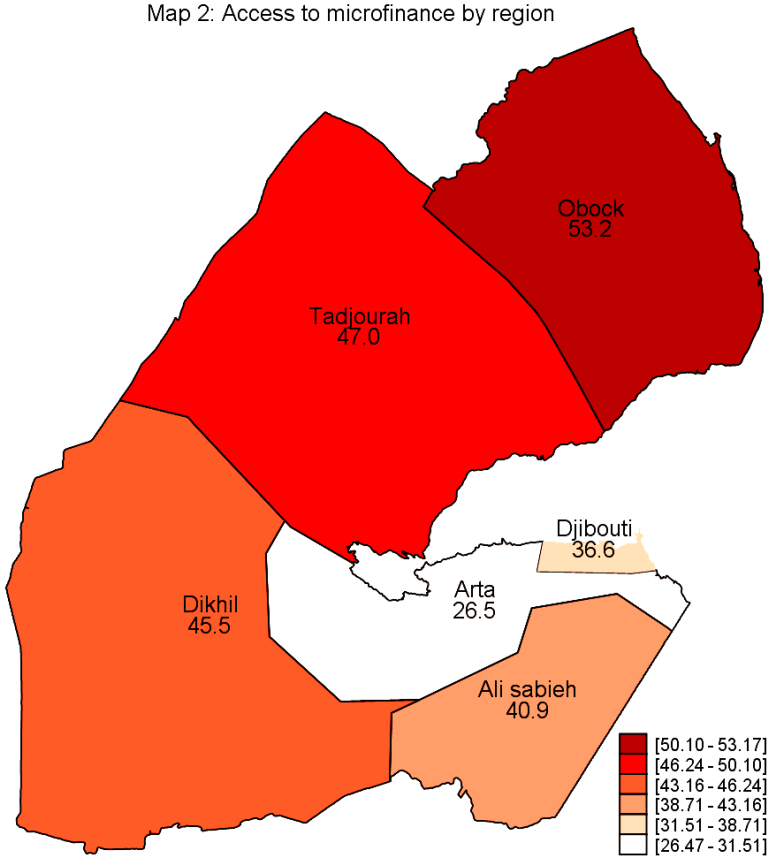
We use a set of variables of interest: (i) participation in the microfinance program, a binary variable indicating whether or not the household has received a loan from a microfinance institution. (ii) loan amount, which is the total amount of the outstanding loan. (iii) the number of loans taken out by households in two ways: (a) as a binary variable, i.e. whether or not women take out loans four or more times; (b) as a continuous variable, which corresponds to the number of loans taken out by households in recent years. (iv) the duration of participation in the microfinance programme is whether or not women have participated in the programme for three years or more.

Approximately 44 per cent of women borrowers use microcredit offered by formal financial institutions (CPECs in Djibouti, North and South), while the remaining 56 per cent take out microcredit from informal lenders (friends, shopkeepers, employers and others) (see Table 1).

In terms of access to microfinance, women beneficiaries in the northern regions (Obock and Tadjourah) each have a 52 per cent and 47 per cent participation rate in the programmes, which remains high at the national level. At the other end of the scale, the southern regions (Dikhil and Ali-sabieh) have a participation rate of 46% and 41% are still far behind the northern regions. In addition, 36% of women in the capital sector take out loans, followed by 27% in Arta (see Map2).

In the analysis, we will first study the overall relationship between access to microfinance and women's autonomy (for the types of dimensions). Subsequently, the analysis is carried out in relation to the number of loans taken out from microfinance institutions by dividing households into two groups: households taking out loans up to four times and less and those taking out loans more than four times. More than 65% of households in the data set took out microcredit up to four times and less. Finally, we conduct an analysis of the length of time that households have participated in the microfinance program by dividing households equally into two groups: those who participated in the program three years and less and those who participated more than three years. More than 27% of the households in the data set were able to participate in the microfinance program for up to three years or less.

Map 2: Access to microfinance by region



Source: Author's calculation using PREPUD

Control variables

The control variables used in our econometric analysis relate to the sociodemographic characteristics of the household: age of the head of the household, marital status, education or schooling levels, geographical regions, household size, economic status (extremely poor, poor, moderately poor and rich) and the ratio of women. 59% of married women have taken out loans from microfinance institutions. 80% of the women who have benefited from microcredits are illiterate, 9% of these women have reached primary school level, while 11% have secondary school level and above. 29% of the women who have benefited from the loans are from the capital, (Djibouti city), while the majority (71%) are from the interior regions, Ali-Sabieh, Arta, Dikhil, Obock and Tadjourah. 6% of women in the extremely poor categories were able to benefit from microcredits, 58%, 25% and 10% respectively for the poor, moderately poor and rich categories.

4.3. Empirical methodology

In this study, the relationship between microfinance and women empowerment, defining the latent variable $Women_i^*$ directly, such that the probit model is structured as follow:

$$Women_i^* = MFI_i\beta + X_i\alpha + \varepsilon_i \quad (1)$$

$$\varepsilon_i \sim NID\ (0,1)$$

$$Women_i = 1\ if\ Women_i^* > 0$$

$$Women_i = 0\ if\ Women_i^* \leq 0$$

Where $Women_i^*$ defines the Women Empowerment Index, taking 1 if the women is empowered and 0 otherwise. Nothing that we also treat the same for the index of

economic empowerment, social empowerment and interpersonal empowerment. MFI_i is vector of microfinance indicators. X_i is a set of additional controlled variables, which are assumed to be exogenous and may influence the women empowerment. ε_i is error term and independent of all explanatory variables. In probit model, function is a standard normal distribution function. β and α are the coefficients of the parameters, which estimated by the method of maximum likelihood.

According to Verbeek (2004), Amemiya, (1981, 1984), Maddala (1983), Lee (1996), Franses and Paap (2001) and Wooldridge (2002)[9], the likelihood contribution of observation i with $Women_i = 1$ is given by $P\{Women_i = 1|MFI_i\} = 1$ as a function of the unknown parameter vector β, and, similarly for $Women_i = 0$. The likelihood function is estimated as follows:

$$L(\beta) = \prod_{i=1}^{N} P\{Women_i = 1|MFI_i; \beta\}^{y_i} P\{Women_i = 0|MFI_i; \beta\}^{1-y_i} \qquad (2)$$

Then it is estimated with the log likelihood function and substitute $P\{Women_i = 1|MFIi;\beta=F(MFIi'\beta)$ we obtain:

$$log\ L(\beta) = \sum_{i=1}^{N} Women_i\ logF(MFI_i'\beta) + \sum_{i=1}^{N}(1 - Women_i) \log\ (1 - F(MFI_i'\beta)) \qquad (3)$$

We then estimate with the first order condition of the maximum likelihood problem. Differentiating with respect to β yields:

$$\frac{\delta log\ L(\beta)}{\delta \beta} = \sum_{i=1}^{N} \left[\frac{Women_i - F(MFI_i'\beta)}{F(MFI_i'\beta)(1-F(MFI_i'\beta))} F(MFI_i'\beta)\right] MFI_i = 0 \qquad (4)$$

According to Verbeek (2004), the first order conditions say that each explanatory variable should be orthogonal to the generalized residual (over the whole sample). This is comparable to the OLS first order conditions, which state that the least squares residuals are orthogonal to each variable in MFI_i.

The solution of equation (4) is the maximum likelihood estimator β. From this estimation, we then calculate the probability that $Women_i = 1$ for a given MFI_i. The probit model specifies the conditional probability:

$$p = \phi(MFI_i'\beta) = \int_{-\infty}^{MFI_i'\beta} \phi(z)dz \qquad (5)$$

$$p = \int_{-\infty}^{MFI_i'\beta} \frac{1}{\sqrt{2\pi}} exp^{-0.5(MFI_i'\beta)^2} dz \qquad (6)$$

Where $\phi(.)$ is the standard normal cdf, with derivative $\phi(z)$ which is the standard normal density function. The probit model marginal effect are:

$$\frac{\delta p_i}{\delta MFI_{ij}} = \phi(MFI_i'\beta)\beta_j \qquad (7)$$

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[9] Amemiya, T. (1981), Qualitative Response Models: A Survey, *Journal of Economic Literature*, 19, 1483–1536.

Amemiya, T. (1984), Tobit Models: A Survey, *Journal of Econometrics*, 24, 3–61.

Franses, P. H. B. F. and Paap, R. (2001), *Quantitative Models in Marketing Research*, Cambridge. University Press, Cambridge.

Lee, M. J. (1996), *Methods of Moments and Semiparametric Econometrics for Limited Dependent Variable Models*, Springer-Verlag, New York.

Maddala, G. S. (1983), *Limited-Dependent and Qualitative Variables in Econometrics*, Cambridge. University Press, Cambridge.

Wooldridge, J. M. (2002), *Econometric Analysis of Cross-Section and Panel Data*, MIT Press, Cambridge, MA.

A guide to modern econometrics: 2nd. edition. Marno Verbeek. John Wiley & Sons, Limited, 2004 - 446 pages

From the equations (1), the estimated results may face the treatment endogeneity effects. We therefore address the treatment endogeneity effects with the instrumental variables. Rationally, the orthogonality of instruments to the error term requires that they be uncorrelated with omitted variables so that, when we are interested in the effect of MFI_i on $Women_i$, and Z_i is an instrument, then Z_i can only affect $Women_i$ through its effect on MFI_i, and not through any other mechanism (Deaton, 2019).

In this paper, our instrumental variables include: l'adhésion à une coopérative de crédit. Chang and Mishra (2008) and Seng (2017) use national identify card, which is required to access to formal loan, as the instrument. The logic of this instrument is as follows: In order to be eligible for a microcredit, one needs to be a member of the credit cooperative such as the CPECs. Members can open a saving account which later is used to obtain the microcredit. The member can borrow up to one million Djiboutian France for which 20% amount is necessary to be present in the savings account.
Membership is free and open to individuals (men, women, poor, non-poor, young people) as well as legal entities (associations, other groups, small businesses). There is no statistical difference between members along any of these lines, indicating that any association with women empowerment (if any) can only pass through the microfinance indicator, the instrumented variable.

Therefore, we can transform the $probit$ model with continuous endogenous regressors, applying with stata commend $ivprobit$, as follows:

$$Women_i^* = \beta X_i + \alpha MFI_i + \varepsilon_i \quad (8)$$

$$MFI_i = \gamma X_i + \xi Z_i + \eta_i$$

Where, Z_i is $1 \times z$ vector of additional instruments. By the assumption, $(\varepsilon_i, \eta_i) \sim N(o, \sigma)$, where $\sigma_{11}$is normalized to one to identify the model. ξ is matrice of parameters. (ε_i, η_i) is independent and identically distributed multivariate for all i. The equation $Women_i$ is observed then:

$$Women_i = \begin{cases} 0 & Women_i^* < 0 \\ 1 & Women_i^* \geq 0 \end{cases} \quad (9)$$

For the equation (9), the Wald test of the exogeneity of the instrumented variables is applied. If the test statistic is not significant, there is not sufficient information in the sample to reject the null that there is no endogeneity. Then a regular $probit$ regression may be appropriate. The point estimates from $ivprobit$ are consistent, though those from $probit$ are likely to have smaller standard errors (StataCorp, 2013). Finally, the minimum chi-squared estimator with the two-step estimators of Newey (1987) will be computed for the endogenous $probit$ model.

In addition, three matching techniques, namely propensity score matching (PSM), inverse probability weighting (IPW), and augmented inverse probability weighting (AIPW) are used to account for the possibility that households that benefited from the microcredit may differ from those that did not benefit could be considered non-random. Average treatment effects (ATE) and average treatment effects on treated individuals (ATT) are obtained. After the SHP estimates, the balance of the treatment groups and the sensitivity are checked. Finally, a range of robustness measures are also carried out .

5. Results

We begin by presenting some descriptive statistics showing difference between borrower and non-borrower households. Table 2 presents bivariate statistics for access to microcredit. We see that borrower and non-borrower households differ little in most of the economic, demographic and geographical features. The borrower households on average have a higher dependency ratio, suggesting a greater need for the working-age members to engage in income-generating activities.

Insert Tables 2 & 3 here please

The relationship between access to the microcredit and women's empowerment (shown in Table 3) is statistically significant at the 1% level for the types of dimensions. Households with access to the program are largely empowered at the socio-economic and interpersonal levels (Table 3, columns 1 to 3). The marginal effects of the microfinance indicators, presented at the bottom of Table 6, show that households with loans from MFIs are 35.4%, 30.9% and 10.1% less likely to be economically, socially and impersonally empowered.

This result is valid for the probit and iv-probit model estimates, with the interest variable used is the amount of loans (shown in Tables 4 and 5). This indicates that the use of microcredit allows for greater empowerment for women.

Insert Table 4 & 5 here please

We also looked at whether there is a link between the number of loans received and women's empowerment. The result is presented in Table 5 and appears to be statistically significant at the 1% level for the types of dimensions. When we retain the binary interest variable of the numbers of loans received, we note that women who have taken out four or more loans from microfinance institutions are 27.7%,23.5% and 6.8% less likely to be economically, socially and interpersonally empowered (Table 5, columns 1 to 3). The results for the number of loans taken out by women, estimated by the iv-probit model (shown in Table 6) follow the same direction as the previous results.

Insert Table 6 & 7 here please

It is possible that women who are already relatively more autonomous tend to participate in the program more than others. However, the significant coefficients of the variables of interest, access to credit and number of loans taken on the indicators of empowerment studied suggest that the microcredit program can empower women who participate in it: a

woman's level of autonomy is likely to increase as she becomes more involved in the program (reflected in the increase in loan size), compared to the initial level (i.e., the level of autonomy in non-recipient status). In other words, a true program effect may be reflected in this trend towards increased autonomy for women, in parallel with their participation in the program. It should also be noted that our autonomy index shows that certain dimensions, economic, social and interpersonal, are more important than others in determining women's empowerment.

Table 2: Female characteristics by access to microfinance program

Variables	Total sample (1)		Non-borrower (2)		Borrower (3)		t-Test of Means differences (4) (2) minus (3)
	Mean/Proportion	SE	Mean/Proportion	SE	Mean/Proportion	SE	lnMean
Dependent variable							
WEI (ref: Empowerment)	0.419	(0.019)	0.414	(0.025)	0.427	(0.028)	-0.013
Household characteristics							
Age of female	48.366	(0.553)	48.806	(0.802)	47.785	(0.727)	1.021
Marital status (ref = married)	0.414	(0.019)	0.362	(0.024)	0.480	(0.029)	-0.118
Education level of female							
Less and primary	0.417	(0.042)	0.389	(0.056)	0.452	(0.064)	-0.062
Secondary and above	0.583	(0.042)	0.610	(0.056)	0.548	(0.064)	0.062
Région (ref : Djibouti)							
Ali-Sabieh	0.135	(0.013)	0.141	(0.018)	0.126	(0.019)	0.016
Arta	0.098	(0.011)	0.128	(0.017)	0.059	(0.014)	0.069***
Dikhil	0.159	(0.014)	0.154	(0.018)	0.166	(0.021)	-0.011
Obock	0.182	(0.015)	0.152	(0.018)	0.222	(0.024)	-0.070***
Tadjourah	0.291	(0.017)	0.272	(0.023)	0.315	(0.027)	-0.042***
Dependency ratio	23.126	(0.489)	24.411	(0.586)	21.471	(0.816)	2.940***
Household size	1.682	(0.028)	1.679	(0.036)	1.685	(0.044)	-0.007***
Wealth statu (ref : Hpoor)							
Poor	0.253	(0.166)	0.293	(0.023)	0.202	(0.203)	0.091***
Middle	0.582	(0.019)	0.514	(0.025)	0.669	(0.027)	-0.155***
Rich	0.059	(0.009)	0.044	(0.010)	0.079	(0.016)	-0.036**

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

Table 3 : Microfinance and women empowerment – Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All	
Variables	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Access to microfinance	1.359***	(0.146)	1.089***	(0.135)	0.317***	(0.154)	1.023***	(0.151)
Age	0.009	(0.006)	0.104**	(0.005)	0.009*	(0.005)	0.018**	(0.005)
Married female	0.499	(0.149)	0.369***	(0.131)	0.298**	(0.125)	0.630***	(0.136)
Education level of female								
Primary	0.002	(0.201)	0.542**	(0.238)	0.591***	(0.164)	0.467**	(0.227)
Secondary	-0.129	(0.229)	0.902***	(0.182)	0.966***	(0.169)	0.625***	(0.229)
Employed								
Yes	-0.404***	(0.143	-0.301**	(0.135)	-0.068**	(0.178)	-0.409***	(0.131)
Region (ref: Djibouti)								
Ali-sabieh	-0.179	0.224)	0.196	(0.152)	0.319**	(0.137)	0.143	(0.226)
Arta	-0.307	(0.293)	0.116	(0.190)	0.204	(0.164)	-0.180	(0.242)
Dikhil	0.435	(0.287)	-0.416*	(0.243)	-0.335	(0.269)	0.333	(0.304)
Obock	0.010	(0.261)	0.447**	(0.196)	0.358	(0.272)	0.296	(0.255)
Tadjourah	0.171	(0.295)	-0.504**	(0.254)	-0.504*	(0.303)	-0.347	(0.319)
Economic status (ref: Poorest)								
Poorer	-0.135	(0.211)	0.202	(0.269)	0.662**	(0.309)	0.237	(0.251)
Middle	0.324**	(0.193)	0.528**	(0.265)	0.964***	(0.297)	0.734**	(0.256)
Rich	0.809***	(0.193)	0.692**	(0.316)	1.083***	(0.399)	0.935*	(0.371)
Dependency ratio	-0.004	(0.004)	0.007*	(0.004)	0.005	(0.004)	0.002	(0.005)
Household size	0.187	(0.093)	0.285***	(0.084)	0.249***	(0.088)	0.332***	(0.095)
Marginal Effect	0.354***	(0.025)	0.309***	(0.031)	0.101**	(0.049)	0.279***	(0.032)
Constant	-0.423	(0.435)	-1.061***	(0.377)	-2.220***	(0.402)	-0.954**	(0.462)
Oberservation	626		625		625		625	

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

Tableau 4: Amounts of loans and women empowerment – Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All components	
Variables	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Amount of loans	1.860***	(0.337)	0.228***	(5.180)	0.783***	(0.003)	0.403***	(0.754)
Age of HH	0.007	(0.005)	0.010**	(0.005)	0.008	(0.005)	0.011**	(0.005)
Married female	0.562	(0.124)	0.453***	(1.125)	0.325**	(0.121)	0.667***	(0.133)
Education of HH (ref: none)								
Primary	0.079	(0.200)	0.437	(2.202)	0.564***	(0.194)	0.412**	(0.213)
Secondary	0.378	(0.197)	0.723	(0.209)	0.899***	(0.194)	0.541***	(0.221)
Employed								
Yes	-0.642	(0.118)	-0.489	(0.120)	-0.096	(0.118)	-0.513***	(0.128)
Region (ref: Djibouti)								
Ali-sabieh	-0.371	(0.170)	0.053	(0.167)	0.257**	(0.160)	0.028	(0.180)
Arta	-0.236	(0.205)	0.137	(0.203)	0.218	(0.203)	-0.120	(0.212)
Dikhil	-0.084	(0.210)	-0.591*	(0.219)	-0.393	(0.218)	-0.124	(0.221)
Obock	-0.111	(0.191)	0.338**	(0.189)	0.329	(0.182)	0.210	(0.201)
Tadjourah	0.038	(0.230)	-0.531**	(0.241)	-0.524*	(0.249)	-0.395	(0.242)
Economic status (ref: Poorest)								
Poorer	0.028	(0.228)	0.285	(0.218)	0.674**	(0.243)	0.313	(0.220)
Middle	0.490	(0.208)	0.636**	(0.202)	0.986***	(0.227)	0.781**	(0.203)
Rich	0.994	(0.294)	0.859**	(0.307)	1.117***	(0.306)	0.967*	(0.324)
Dependency ratio	-0.006	(0.005)	0.005*	(0.005)	0.004	(0.005)	0.001	(0.005)
Househlold size	0.154	(0.085)	0.266***	(0.087)	0.246***	(0.083)	0.322***	(0.093)
Marginal Effect	0.063***	(0.958)	0 .070***	(0.136)	0.025**	(0.942)	0.114***	(0.203)
Constant	0.968	(0.369)	1.613***	(0.370)	2.389***	(0.383)	0.166**	(0.387)
Observation	626		625		625		625	

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

Tableau 5: Amounts of loans and women empowerment – IV – Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All	
Variables	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Amounts of loans	0.450***	(0.306)	0.414***	(0.518)	0.157***	(0.578)	0.460***	(0.528)
Age of HH	0.002	(0.005)	0.005**	(0.005)	0.007	(0.005)	0.007**	(0.005)
Married female	0.401	(0.116)	0.347***	(1.125)	0.310**	(0.121)	0.580***	(0.129)
Education of HH (ref:none)								
Primary	0.088	(0.179)	0.359	(2.202)	0.550***	(0.193)	0.337**	(0.202)
Secondary	0.386	(0.386)	0.494	(0.209)	0.861***	(0.195)	0.342***	(0.210)
Employed								
Yes	0.141	(0.123)	0.119	(0.128)	-0.006	(0.131)	-0.227***	(0.138)
Region (ref: Djibouti)								
Ali-sabieh	-0.466	(0.153)	-0.134	(0.156)	0.204**	(0.163)	-0.150	(0.170)
Arta	-0.104	(0.189)	0.137	(0.190)	0.245	(0.202)	-0.044	(0.201)
Dikhil	0.169	(0.190)	-0.457*	(0.205)	-0.371	(0.217)	-0.079	(0.207)
Obock	-0.113	(0.174)	0.263**	(0.178)	0.318	(0.181)	0.165	(0.189)
Tadjourah	-0.038	(0.209)	-0.473**	(0.226)	-0.517*	(0.248)	-0.360	(0.228)
Economic status (ref: Poorest)								
Poorer	-0.053	(0.206)	0.199	(0.207)	0.655**	(0.242)	0.242	(0.210)
Middle	0.210	(0.192)	0.405**	(0.197)	0.933***	(0.230)	0.596**	(0.202)
Rich	0.494	(0.274)	0.489**	(0.291)	1.029***	(0.310)	0.714*	(0.312)
Dependency ratio	-0.003	(0.004)	0.005*	(0.004)	0.004	(0.004)	0.001	(0.005)
Household size	0.114	(0.077)	0.212***	(0.081)	0.239***	(0.083)	0.268***	(0.088)
Marginal Effect	0..450***	(0.306)	0.414***	(0.518)	0.157***	(0.942)	0.460***	(0.528)
Constant	0.978	(0.336)	1.494***	(0.349)	2.417***	(0.382)	0.1487**	(0.369)
Oberservation	626		625		625		625	
Wald test of exogeneity								
Chi2 (1)	72.910		36.920		2.370		20.180	
Prob > chi2	0.000		0.000		0.124		0.000	

Table 6: Numbers of loans and women empowerment – Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All	
Variables	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Number of loan (ref: less than 4 loan)								
More than 4 loans	0.956***	(0.146)	0.776***	(0.149)	0.212***	0.156	0.727***	0.147
Age	0.007	(0.006)	0.009*	0.005	0.008	0.005	0.011**	0.005
Married female	0.494***	(0.141)	0.369***	0.119	0.305***	0.124	0.642***	0.130
Education (ref:)								
Primary	0.005	0.206	0.542**	0.236	0.584***	0.165	0.451**	0.228
Secondary	0.155	0.213	0.815***	0.169	0.943***	0.169	0.579***	0.211
Employed								
Yes	0.628***	0.136	0.493***	0.133	0.127	0.174	0.577****	0.140
Region (ref: Djibouti)								
Ali-sabieh	0.353	0.335	0.035	0.203	0.279*	0.145	0.004	0.304
Arta	0.430	0.363	0.009	0.224	0.168	0.167	0.275	0.305
Dikhil	0.142	0.381	0.596***	0.240	0.390	0.258	0.151	0.359
Obock	0.068	0.359	0.326	0.231	0.334	0.277	0.193	0.325
Tadjourah	0.132	0.411	0.483	0.309	0.504	0.310	0.340	0.397
Economic status (ref: Poorest)								
Poorer	0.033	0.193	0.274	0.258	0.679**	0.309	0.304	0.245
Middle	0.401**	0.187	0.596**	0.254	0.987***	0.297	0.784***	0.251
Rich	0.960***	0.290	0.868***	0.328	1.145****	0.411	1.107***	0.372
Dependency ratio	0.003	0.005	0.008**	0.004	0.005	0.004	0.003	0.005
Househlold size	0.172**	0.091	0.275***	0.081	0.249***	0.089	0.314***	0.094
Marginal Effect	0.277***	0.035	0.235***	0.042	0.068***	0.050	0.210***	0.041
Constant	1.242***	0.517	1.745***	0.440	2.242***	0.422	1.625***	0.524
Oberservation	626		625		625		625	

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

Tableau 7: Number of loans and women empowerment – IV– Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All	
Variables	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Number of loans	0.400***	(0.030)	0.338***	(0.034)	0.118***	(0.044)	0.335***	(0.037)
Age of HH	0.009	(0.005)	0.011**	(0.005)	0.009**	(0.005)	0.020**	(0.005)
Married female	0.512	(0.112)	0.402***	(1.122)	0.319***	(0.120)	0.640***	(0.129)
Education of HH (ref: none)								
Primary	0.041	(0.192)	0.460	(0.197)	0.570**	(0.193)	0.409**	(0.206)
Secondary	0.198	(0.190)	0.737	(0.199)	0.928***	(0.193)	0.509***	(0.208)
Employed								
Yes	-0.193	(0.129)	-0.148	(0.130)	-0.018***	(0.129)	-0.251***	(0.137)
Region (ref: Djibouti)								
Ali-sabieh	0.105	(0.166)	0.381	(0.162)	0.391	(0.162)	0.326	(0.174)
Arta	-0.148	(0.205)	0.304	(0.199)	0.272	(0.204)	0.032	(0.209)
Dikhil	0.506	(0.206)	-0.241*	(0.215)	-0.279	(0.221)	0.154	(0.216)
Obock	0.165	(0.189)	0.548**	(0.186)	0.402	(0.182)	0.421	(0.196)
Tadjourah	0.045	(0.227)	-0.525**	(0.238)	-0.402	(0.182)	-0.398	(0.237)
Economic status (ref: Poorest)								
Poorer	-0.111	(0.225)	0.169	(0.216)	0.645	(0.242)	0.201	(0.217)
Middle	0.312	(0.208)	0.489**	(0.203)	0.951**	(0.228)	0.684**	(0.206)
Rich	0.528	(0.295)	0.476**	(0.304)	1.005*	(0.310)	0.714*	(0.329)
Dependency ratio	-0.010	(0.004)	0.003*	(0.004)	0.003	(0.005)	0.714	(0.323)
Househlold size	0.138	(0.083)	0.236***	(0.084)	0.240***	(0.082)	-0.289***	(0.089)
Marginal Effect	0..450	(0.306)	0.414***	(0.518)	0.118***	(0.044)	0.118***	(0.044)
Constant	1.666	(0.365)	2.054***	(0.363)	2.566**	(0.388)	1.946**	(0.374)
Oberservation	626		625		625		625	
Wald test of exogeneity								
Chi2 (1)	44.980		28.73		3.970		20.21	
Prob > chi2	0.000		0.000		0.046		0.000	

Does the duration of participation play a role? This is the question we asked ourselves whether it can be related to the numbers of loans taken out by women. For the estimates of the iv-probit model, we use the continuous variable of the number of loans taken out from microfinance institutions.

Estimates of the period of program participation using the probit and iv-probit model are given in Tables 7 and 8. Having benefited four or more times from microcredit is significant at the 1% threshold for all three types of dimensions, when women participate in the program for three years or more. At the other end of the chain, the relationship becomes less significant for households that participated in the programmes three years and less. Overall, we find that time is a significant factor when program participation is long-term, as the relationship is found to be significant regardless of the empirical method used.

Insert Table 8 & 9 here please

The control variables included in the estimates are more or less significantly associated with women's autonomy. The positive and significant coefficient for married women suggests that many married women receive credit and that they should obtain a higher loan amount.

5. Sensitivity and robustness measures

5.1. Matching estimations

To address the problem of endogeneity, we estimate our model using three propensity score methods: propensity score matching (PSM), inverse probability weighting (IPW) and augmented inverse weighting (AIPW). Matching estimates are based on Rubin's causal model (Rosenbaum & Rubin, 1983).

Propensity score matching (PSM) matches treated and untreated individuals on the basis of a propensity score for participation given observable characteristics of the individual. Nevertheless, the idea of Inverse Probability Weighting (IPW) gives greater weight to those who are unlikely to receive treatment. The aim is to obtain a pseudo-sample (or weighted sample) in which the distribution of covariates is identical between exposed and unexposed individuals. Finally, AIPW combines regression fitting aspects and inverse probability weighted methods to estimate the means of potential outcomes and average treatment effects. This method is "doubly robust" (Cao, Tsiatis, and Davidian, 2009).

The use of propensity score methods gives both the most common estimates, namely: "mean treatment effect on treated individuals" (ATT), which is the effect on individuals in the treatment group, and "mean treatment effect (ATE), which is the effect on all individuals (treatment and control). However, ATE is more interesting if each treatment can potentially be offered to each subject, whereas ATT is preferable when patient characteristics are more likely to determine the treatment received.

Tables 10 and 11 present the results of propensity score (PS) estimates. The results of the latter correspond or are identical to those of our base estimates, i.e. the probit and iv-probit estimates. When households have access to microcredits, the ATT for the three selected dimensions of women's autonomy (economic, social and interpersonal) is statistically significant at the 1% threshold. The ATT for the households that have benefited compared to those that have not is 15.9%, 32.9% and 32.4% for

Table 8: Number of loans and women empowerment (Duration) - Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All components	
Variables	**(Duration≤3)**	**(Duration>3)**	**(Duration≤3)**	**(Duration>3)**	**(Duration≤3)**	**(Duration>3)**	**(Duration≤3)**	**(Duration>3)**
Number of loans	-0.255 (0.266)	1.004*** (0.192)	-0.144 (0.307)	0.926*** (0.309)	-0.242 (0.439)	0.250*** (0.201)	-0.252 (0.344)	1.172*** (0.386)
Age	-0.008 (0.011)	0.014* (0.008)	-0.013 (0.013)	0.015*** (0.006)	-0.006 (0.009)	0.014** (0.006)	-0.017 (0.014)	0.016** (0.006)
Married women	0.644** (0.285)	0.419*** (0.159)	0.477 (0.291)	0.344** (0.344)	0.446** (0.236)	0.262* (0.153)	0.843*** (0.321)	0.568*** (0.144)
Women education (ref: none)								
Primary	-0.140 (0.360)	0.002 (0.233)	0.444 (0.581)	0.543** (0.283)	0.503 (0.370)	0.660*** (0.223)	0.259 (0.514)	0.431* (0.258)
Secondary	-0.177 (0.378)	-0.280 (0.318)	0.734 (0.501)	0.820*** (0.201)	1.085*** (0.421)	0.912*** (0.215)	0.299 (0.514)	0.581** (0.259)
Employed								
Yes	-0.401** (0.196)	0.685*** (0.204)	-0.061 (0.149)	0.650 (0.174)	0.197 (0.228)	0.340** (0.168)	-0.242 (0.181)	-0.635*** (0.189)
Region (ref: Djibouti)								
Ali-sabieh	-0.229 (0.213)	0.085*** (0.354)	0.073 (0.263)	0.186 (0.203)	0.267 (0.190)	0.394** (0.202)	0.004 (0.231)	0.202 (0.318)
Arta	-0.758* (0.422)	0.079*** (0.356)	-0.533 (0.454)	0.324* (0.203)	-0.591 (0.381)	0.554 (0.211)	-0.966** (0.433)	0.092 (0.284)
Dikhil	-0.677* (0.411)	0.582** (0.415)	-1.087*** (0.357)	0.291 (0.279)	-1.128* (0.580)	0.033** (0.254)	-0.856*** (0.263)	0.211 (0.379)
Obock	-0.252 (0.216)	0.115 (0.430)	-0.043 (0.356)	0.544** (0.256)	-0.423 (0.509)	0.832*** (0.254)	-0.210 (0.340)	0.494 (0.351)
Tadjourah	-0.244 (0.424)	0.401*** (0.509)	-0.589 (0.388)	0.452 (0.360)	-0.432 (0.733)	0.551 (0.357)	-0.911** (0.363)	-0.125 (0.480)
Economic status (ref: Poorest)								
Poorer	-0.853 (0.617)	0.206 (0.285)	-0.604 (0.548)	0.421 (0.361)	1.308** (0.637)	0.555 (0.357)	-0.490 (0.633)	0.448 (0.340)
Middle	-0.456 (0.499)	0.764*** (0.246)	-0.401 (0.491)	0.791** (0.338)	1.356** (0.613)	0.953*** (0.324)	-0.274 (0.547)	1.013*** (0.326)
Rich	-0.232 (0.649)	1.319*** (0.311)	-0.430 (0.642)	1.256*** (0.461)	1.297* (0.727)	1.457*** (0.399)	-0.338 (0.710)	1.563*** (0.535)
Dependency ratio	0.008 (0.007)	-0.014** (0.007)	0.001 (0.009)	0.013** (0.006)	-0.003 (0.009)	0.012* (0.007)	0.009 (0.009)	-0.002 (0.007)
Household size	0.307 (0.207)	0.115 (0.114)	0.186 (0.139)	0.352*** (0.099)	0.070 (0.120)	0.422*** (0.103)	0.286 (0.184)	0.362*** (0.102)
Marginal Effect	0.077 (0.080)	0.249*** (0.041)	0.040 (0.040)	0.266*** (0.082)	0.079 (0.145)	0.072 (0.057)	0.057 (0.076)	0.335*** (0.985)
Constant	1.081* (0.625)	1.765** (0.699)	1.406** (0.619)	2.549*** (0.504)	1.180 (0.932)	3.202*** (0.485)	1.543** (0.667)	2.252*** (0.631)
Oberservation	172	454	172	453	172	453	172	453

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

Table 9: Numbers of loans and women empowerment (Duration) – IV- Probit estimation

	Economic empowerment		Social empowerment		Interpersonal empowerment		All components	
Variables	(Duration≤3)	(Duration>3)	(Duration≤3)	(Duration>3)	(Duration≤3)	(Duration>3)	(Duration≤3)	(Duration>3)
Numbers of loans	0.113 (0.826)	0.343*** (0.048)	0.069 (0.555)	0.350*** (0.526)	0.007 (0.832)	0.120*** (0.056)	0.106 (0.128)	0.379*** (0.053)
Age	0.010 (0.369)	0.016* (0.006)	0.014 (0.039)	0.018*** (0.006)	0.006 (0.426)	0.015** (0.006)	0.018 (0.655)	0.018** (0.005)
Married women	0.677** (0.331)	0.427*** (0.160)	0.498 (0.231)	0.325** (0.150)	0.430** (0.330)	0.258* (0.150)	0.884*** (0.507)	0.516*** (0.152)
Women education (ref: none)								
Primary	0.172 (0.199)	0.025 (0.241)	0.453 (0.122)	0.584** (0.234)	0.496 (0.200)	0.670*** (0.232)	0.268 (0.307)	0.470* (0.237)
Secondary	0.250 (0.920)	0.095 (0.251)	0.726 (0.599)	0.994*** (0.239)	1.111*** (0.926)	0.979*** (0.235)	0.269 (0.142)	0.741** (0.242)
Employed								
Yes	0.402** (0.209)	0.268*** (0.180)	0.048 (0.139)	0.257 (0.177)	0.206 (0.209)	0.203** (0.174)	0.230 (0.321)	0.213*** (0.176)
Region (ref: Djibouti)								
Ali-sabieh	0.182 (0.972)	0.142*** (0.226)	0.097 (0.654)	0.387 (0.206)	0.226 (0.980)	0.458** (0.206)	0.021 (0.151)	0.400 (0.208)
Arta	0.683* (0.120)	0.093*** (0.275)	0.489 (0.793)	0.498* (0.250)	0.624 (0.121)	0.612 (0.255)	0.929** (0.186)	0.282 (0.251)
Dikhil	0.651 (0.562)	0.860** (0.259)	1.087*** (0.354)	0.003 (0.260)	1.139* (0.569)	0.058** (0.261)	0.861*** (0.876)	0.488 (0.247)
Obock	0.212 (0.300)	0.352 (0.272)	0.082 (0.204)	0.793** (0.243)	0.409 (0.304)	0.916*** (0.245)	0.172 (0.467)	0.730 (0.242)
Tadjourah	0.179 (0.105)	0.132*** (0.298)	0.563 (0.690)	0.731 (0.309)	0.428 (0.106)	0.624 (0.324)	0.885** (0.163)	0.380 (0.281)
Economic status (ref: Poorest)								
Poorer	0.787 (0.984)	0.030 (0.309)	0.590 (0.649)	0.220 (0.263)	1.285** (0.996)	0.498 (0.282)	0.456 (0.153)	0.222 (0.252)
Middle	0.425 (0.636)	0.606*** (0.281)	0.396 (0.419)	0.620** (0.247)	1.329** (0.643)	0.897*** (0.268)	0.246 (0.989)	0.795*** (0.242)
Rich	0.240 (0.110)	1.120*** (0.401)	0.459 (0.643)	0.959*** (0.413)	1.295* (0.113)	1.364*** (0.414)	0.357 (0.173)	1.120*** (0.423)
Dependency ratio	0.006 (0.034)	0.014** (0.006)	0.001 (0.228)	0.013** (0.007)	0.002 (0.343)	0.012* (0.007)	0.008 (0.053)	0.009 (0.006)
Household size	0.306 (0.108)	0.119 (0.110)	0.184 (0.696)	0.337*** (0.107)	0.073 (0.111)	0.419*** (0.107)	0.289 (0.171)	0.335*** (0.107)
Marginal Effect	0.113 (0.826)	0.343*** (0.048)	0.069 (0.554)	0.350*** (0.052)	0.007 (0.832)	0.120 (0.056)	0.106** (0.128)	0.379*** (0.053)
Constant	0.657* (0.237)	2.276** (0.493)	1.143 (0.157)	3.047*** (0.461)	1.368 (0.239)	3.403 (0.487)	0.111** (0.368)	2.645*** (0.453)
Oberservation	172	454	172	453	172	453	172	453

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

the dimensions of economic, social and interpersonal empowerment respectively. The result for the aggregate women empowerment indicator is also significant with an average effect of 42% (column 4).

Insert Table 10 & 11

Table 10 : Microfinance and women empowerment –Probit estimation

Propensity socre match	Economic empowerment	Social empowerment	Interpersonal empowerment	All
Unmatched	0.159*** (0.685)	0.329*** (0.774)	0.324** (0.176)	0.420*** (0.831)
ATT	0.159*** (0.154)	0.3294*** (0.713)	0.3244** (0.132)	0.4201*** (0.791)
Observation	691	625	625	690

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

5.3. Testing multiple hypotheses

We perform the multi-variance and covariance (MANOVA) tests using the composite autentication indicator. The results of the four statistics (Wilks' Lambda, Trace de Pillai, Laweley-Hotelling and Roy) show that the null hypothesis of equality of means of access to microcredit is statistically significant at the 1% level.

Finally, we use the Bonferroni correction to test the statistical significance of the regression coefficients of our variables of interest. The method corrects the p-value in the case where several tests are carried out simultaneously on the same data. The Bonferroni corrections for 4 pairwise comparisons using the estimate of women's economic autonomy as the first pair. We notice that the four pairs are significantly different at the 1% level.

Insert Table 12 & 13

Table 11: Microfinance and women empowerment – IPW and AIPW estimation.

Inverse-Propability socre match	(1)		(2)		(3)		(4)	
	Economic empowerment	POmean	Social empowerment	POmean	Interpersonal empowerment	POmean	All Components	POmean
ATE	0.145*** (0.052)	0.620*** (0.039)	0.086*** (0.046)	0.722*** (0.035)	0.082** (0.054)	0.467*** (0.038)	0.125*** (0.040)	0.775*** (0.032)
ATET	0.135*** (0.055)	0.644*** (0.043)	0.739*** (0.038)	0.739*** (0.038)	0.083** (0.057)	0.490*** (0.045)	0.118*** (0.039)	0.800 (0.033)
Observation	302	302	302	302	302	302	302	302
Augmented IPW								
ATE	0.145*** (0.052)	0.620*** (0.039)	0.086*** (0.046)	0.722*** (0.035)	0.082** (0.054)	0.467*** (0.038)	0.125** (0.040)	0.775*** (0.032)
Observation	302	302	302	302	302	302	302	302

Source: Authors' calculations

Notes: Standard errors given in parentheses. *** p< 0.01; **p<0.05; *p<0.1

Table 12: Multivariate analysis of variance and covariance

Source	Statistic		Df	F (df1, df2)		F	Prob>F
Access to microfinance	W	0.6210	1	4.0	685.0	104.53	0.0000e
	P	0.3790		4.0	685.0	104.53	0.0000e
	L	0.6104		4.0	685.0	104.54	0.0000e
	R	0.6104		4.0	685.0	104.55	0.0000e
Residual		688					
Total		689					

Source : Authors' calculations

W = Wilks' lambda, L = Lawley-Hotelling trace, P = Pillai's trace R = Roy's largest root

e = exact, a = approximate, u = upper bound on F

Table 13 : Bonferroni correction

Equations	Contrast	Std.Err.	Bonferroni	
			T	P>|t|
2 vs 1	0.426	0.000	-16.60	0.000
3 vs 1	0.810	0.000	-12.65	0.000
3 vs 2	0.176	0.000	-4.83	0.000
2 vs 3	0.782	0.000	-12.01	0.000

Source: Authors' calculations.

4 number of comparisons

6. CONCLUSION

Using household survey data on the use of microfinance services conducted in 2015 in the six major regions of Djibouti. This study seeks to determine whether participation in the microfinance program is linked to women's greater autonomy. To do so, we construct a composite indicator of women's autonomy that measures women's control over various aspects of their lives and their environment, such as participation in household decisions, control over income, ownership of property and exposure to the media, and their health. The index is then used in three dimensions: economic, social and interpersonal. In addition to this, we also used a number of the estimation techniques and also perform a range of robustness measures. Our empirical results reveal that microcredit not only has positive and significant effects on women's autonomy, but that these effects increase as the number of loans taken out increases and as the length of time in the program increases. It is possible that women who are already relatively more self-reliant tend to participate in the program more than others. However, the significant coefficients of the interest variables, number of loans taken out, and access to credit on the indicators of autonomy studied suggest that the microcredit program may increase the autonomy of the women who participate: a woman's level of autonomy is likely to increase as she becomes more involved in the program (reflected in the increase in loan size), relative to the baseline level (i.e., the level of autonomy in non-recipient status). In other words, a true program effect may be reflected in this trend toward increased autonomy for women, in parallel with their participation in the program. It is also worth noting that our autonomy index shows that certain dimensions, economic, social and interpersonal, are more important than others in determining women's autonomy. Regardless of the specifications and econometric techniques used, our results are robust. Although women's autonomy is an elusive concept and an ideal index, there is a need to decouple autonomy from microcredit, either through policies aimed at further empowering women or by increasing access to microcredit for women with low levels of empowerment.

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Tableau 1: Data description

Variable	Definition	Proportion/Mean
Dependent variable		
Women empowerment	A composite index measure women's control overs various aspect of their lives and environements, such as participation in household decision-making, control over income, their asset ownership and media exposure, and their health domain. From these dimensions women are grouped into two categories: 1. if the woman is empowered, 0 otherswise.	0.42 0.58
Economic empowerment	Dummy variable, takes the value of 1 if the female is empowered economicaly, 0 otherwise.	0.39 0.61
Social empowerment	Dummy variable, takes the value of 1 if the female is empowered socialy, 0 otherwise.	0.11 0.89
Interpersonal empowerment	Dummy variable, takes the value of 1 if the female is empowered interpersonnaly, 0 otherwise.	0.41 0.59
Variables of interest		
Loan access	1 if the household has outstanding loan last year, 0 otherwise.	0.44 0.56
Amount of loan	Continuous variable corresponds to the total of amount of outsanding loan for the last years	96 185
Numbers of loans	Dummy varaibles, takes the value of 1 if the household acquired the loan more than four times, 0 otherwise.	0.34 0.66
Numbers of loans	Continuous variable corresponds to the number of loans taken by the households for the last years.	1.29
Duration	1 if the household has participated in the program more than three years, 0 otherwise.	0.69 0.31
Control variables		
Age of household head	Age of household head (in years)	49.35
Marital status	1 if the household head is married, 0 otherwise.	0.74 0.26
Women emplowed	Dummy variable, takes the value of 1 if the female is employed, 0 otherwise	0.42 0.58
Women education	Categorical variable, takes the value of 1 if household head has primary or no education, 2.secondary level and 3. Higher education.	0.36 0.53 0.11
Region	Categorical variable, takes the value of 1 if the household lives in : 1.Djibouti, 2. Ali-sabieh 3. Arta, 4. Dikhil, 5. Obock and 6.Tadjourah.	0.16 0.25 0.16 0.16 0.13 0.14
Region dummy	Binary variable takes 1 if head lives in Djibouti, 0 otherwise	0.25 0.75
Household size	Number of household members.	1.68

Dependency ratio	Female ratio (ratio of household members under age of 15 years or over 60 years to total members).	16.17
Wealth status	Categorical form, takes the value 1 if female in poorest, 2 if is poorer, 3 if is middle, richest otherswise 4.	0.06 0.58 0.25 0.10
Instrumental variable		
Membership	1 if the household has membership for at least one month, 0 otherwise.	0.37 0.63

Source: Authors' calculations using PREPUD 2015

APPENDIX

Table A1 : Empowerment indicator

Ei (i=1,2,…18)	Indicators	Description of indicator	Mean	S.D
Control over financial assets				
E1	CINC	Control over own income	0.160	0.367
E2	PMIA	Female who most often in the activity	0.170	0.376
Involvement in decision making				
E3	LAND	purchase or sale of land	0.050	0.210
E4	HOUS	house repairing	0.046	0.197
E5	IIGA	involvement in IGA	0.171	0.376
E6	SIGA	Strengthen IGA	0.171	0.376
E7	IGAOH	involvement in IGA outside the home	0.084	0.277
Women asset ownership				
E8	TELIN	telephone internet subscription	0.062	0.242
E9	LAPT	Independently purchase laptob	0.146	0.354
E10	REFRE	Independently purchase Refrigerator and freezer	0.356	0.479
E11	STOV	Independently purchase stove	0.724	0.259
E12	KSTOV	Independently purchase Kerosene stove	0.439	0.497
Health Domain				
E13	EXPH	Health expenditure	0.108	0.311
Media exposure				
E14	RADA	Acces to radio	0.619	0.486
E15	ATV	Access to TV	0.619	0.486
E16	AMUC	Access to music channel	0.619	0.486
E17	APAA	Access to parabolic antenna	0.619	0.486