Credit risk in the microfinance industry: The role of gender affinity

Abstract

This study explores the role played by gender in lending transactions and, specifically, its effects on the loan portfolio credit risk of microfinance institutions (MFIs). Using a multicountry dataset of developing countries, where MFIs mainly operate, the analysis shows that a higher proportion of female loan officers increases the loan portfolio at risk. Nonetheless, we also find that this positive relationship is negatively mediated by the *gender affinity* between female loan officers and female borrowers. Gender affinity suggests that female loan officers are more likely to lend to female borrowers and this reduces the default rate of loans offered by MFIs.

Keywords: Microfinance; Gender; Entrepreneurship.

1. Introduction

One of the main concerns faced by microfinance institutions (henceforth, MFIs) is the opacity of information in the assessment of credit applicants (Chakrabarty and Bass 2014a, b). This frequently severe opacity is due to the fact that the population served by MFIs comprises female micro-entrepreneurs[1] who lack a credit history, previous experience as borrower and are amongst the poorest in their society (Agier and Szafarz 2013a). MFIs operate in an environment characterized by a scarcely developed institutional and regulatory framework where the granting of (micro) loans is based on lending decisions not relaying on financial collaterals. To overcome this issue, lending decisions are generally based on the social collaterals of credit applicants, that is, on their personal reputation and other types of soft data (Chakrabarty and Bass 2014a, b). Essentially, MFIs are negatively affected by information asymmetry in their lending transactions.

To compensate the lack of objective (hard) information, MFIs usually rely on soft data, that is, information that is not easily quantifiable, verifiable, and communicable. To achieve this, MFIs use relationship lending (Boot and Thakor 2000) - also known as relational banking - a lending approach under which 'lenders acquire information over time through contact with the firm, its owner, and its local community on a variety of dimensions, and use this information in their decisions about the availability and terms of loans' (Berger and Udell 2002 pp. F32). Therefore, relationship lending is based on *relational contracts*, which foster the informal relationship that arise between people who set, interpret, enact, and enforce formal contracts (Sorenson and Rogan 2014). Relational contracts acquire particular importance in non-regulated, underdeveloped environments, as in the microfinance industry, where large information gaps enhance the value generated by interpersonal relationships between loan officers and applicants (Canales and Greenberg 2016). As pointed out by Ansari et al. (2012), in microfinance loan officers grant microcredits on the basis of the social capital of borrowers. Consequently, a critical part of a loan officer's job is relational (Buttner and Rosen 1988), in the sense that it relies on building personal interactions with borrowers to overcome the information gap.

[1] The ultimate goal of microfinance industry is the alleviation of poverty through entrepreneurship. Accordingly, MFIs normally grant micro loans to people, preferably women, on the bottom of the socio-economic pyramid: low-income individuals, rural population and ethnic minorities. These loans provide funds for small businesses which can generate profits that will improve living conditions of borrowers.

In this environment, gender becomes a fundamental relational variable that functions as a catalyst for social, cultural, institutional, emotional and behavioural factors. Previous research crucially posits that in contractual relationships the behavior of individuals varies depending on the gender of the counterpart (Dufwenberg and Muren 2006). Accordingly, the literature shows that in the lending market there are two types of gender bias: the first one caused by stricter lending criteria (Orser et al. 2000) and the second linked to worse lending conditions (Cozarenco and Szafarz 2018; Brana 2013). These biases are accentuated in microfinance, where the relational approach implies that the granting of (small) loans is based on the trust, cooperation and close relationships between the loan officers and borrowers. As found by Agier and Szafarz (2013a), MFIs' loan officers incorporate their subjective, gender-biased preferences in loan granting decisions. Social capital, therefore, becomes women's capital in the presence of gendered barriers to accessing economic capital. The role played by women in the family and the community at large increases their capability of successfully building and maintaining strong networks (Maclean 2010; Janssens 2010).

Thus, the main objective of this study is to explore the role played by the gender of loan officers and borrowers in lending transactions and its effects on the loan portfolio credit risk of the MFIs. The loan portfolio credit risk measures the failure rate of all loans held by the lending institution, which is calculated as the proportion of non-performing loans with respect to the total loans granted. To do so, we employ data on MFIs from 52 developing countries, where the microfinance industry mostly operates. To our knowledge, only Beck and colleagues (2013) have conducted research comparing the effect of loan officers' gender on the credit risk of lending institutions. Using a loan-level data set from an Albanian commercial bank, the study finds that loans managed by female loan officers have higher repayment rates and lower defaults in comparison to those managed by their male counterparts. Although useful, this study has one important limitation as it only focuses on the impact of gender in the lending process from the point of view of the loan officer. Therefore, to provide a more complete picture of the gender effect in the loan market, we investigate the consequences on credit risk of the presence of women on both sides of loan transactions, that is, as loan officers (supply side) *and* as borrowers (demand side). Essentially, we test the existence of a gender driver – what we term as *gender affinity* - between women in speculative positions (lender-borrower) within lending

transactions. This, in turn, is assumed to affect the loan portfolio quality of lenders. Basically, we analyze whether there is a mediated relationship between female loan officers and loan portfolio credit risk through female borrowers.

Our gender affinity hypothesis is based on the presumption that loan granting rates are higher when credit officers and applicants have common experiential (social, economic and cultural) backgrounds. Previous studies have looked at the gender effect on credit risk, but in our view they have downplayed its influence by solely focusing on either the impact of female loan officers (Beck et al. 2013) or female borrowers (d´Espallier et al. 2011), leaving unexplored the gender nexus among the supply and demand sides in loan operations. Thus, as far as we know, this is the first study that aims to look simultaneously at the lending process in its entirety, providing a more encompassing view of the effect, in terms of credit risk, of gender in the loan market.

Summarising our main findings, we can highlight three main contributions to the current literature. First, in line with previous studies, we show that the direct effect of female loan officers is to increase the loan portfolio risk. However, as a second important contribution our findings suggest that the combined (or indirect) gender effect of female loan officers *and* female borrowers is to decrease portfolio credit risk of MFIs. In other words, the results show that gender affinity has a positive net effect on the overall performance of MFIs. Third, our findings suggest that the existence of a gender driver is not limited to the positive impact on credit risk in the lending process. What we also notice is that in microfinance women are more likely to interact with their peers. Specifically, our analysis shows that female loan officers appear to lend more to female applicants. This is crucial on two counts. First, as reported above, it reduces loan portfolio risk given that female borrowers have lower loan default rates. Second, it provides female micro-entrepreneurs with funding opportunities they would otherwise not have.

The rest of the paper proceeds as follows. Section 2 provides an overview of the literature on the relationships between gender, micro-entrepreneurship and credit risk in microfinance and also develops our hypotheses. Section 3 presents the data and describes the methodology adopted while Section 4 summarises the main results and discusses the significance of the findings. Lastly, Section 5

draws the conclusions and highlights the implications of this research, including suggestions for future studies.

2. Theoretical Framework and Hypotheses

In the lending market, the relationship between lenders and borrowers is strongly affected by asymmetric information, in particular in relation to the well-known ex-ante moral hazard (Stiglitz 1990) and adverse selection (Ghatak 2000) problems. Asymmetric information problems arise from different information levels between the participating counterparts (loan officers and credit applicants) in lending transactions. To mitigate these problems, lenders need to capture as much as possible information about credit applicants. To do so, two complementary approaches are normally employed. On the one hand, lenders seek to incorporate in the credit assessment *soft information* related to borrowers via establishing a close interpersonal relationship with credit applicants. On the other hand, lenders aim to obtain objective data - *hard information* – derived from the socio-economic status of borrowers by using credit bureaux and other external sources of information such as income level and assets possessed.

The extant literature specifically highlights the importance of obtaining soft information on borrowers to minimize asymmetric information problems faced by lenders. It is noted that lenders´ loan approval decisions are crucially affected by social, cultural, emotional and behavioural factors (Bellucci et al. 2010). Indeed, even in the golden age of big data, loan officers of commercial banks in developed countries – who are aided by readily available credit scoring tools and other sophisticated statistical models to evaluate credit applicants – still rely on intuitive analysis when making lending decisions (Trönnberg and Hemlin 2014). Thus, Serrano-Cinca et al. (2016) highlight the importance of including non-financial information from borrowers, loans and business projects in the design of credit scoring models. With reference to the microfinance sector and in alignment with its social mission, the authors suggest that a social and environmental dimension needs to be incorporated in the credit risk management of MFIs.

So, to make lending decisions, loan officers use *relational contracts*, which are distinct from the more traditional *formal contracts* properly specifying rights and obligations of the counterparts. As such, relational contracts represent informal relationships between the two sides of a lending

transaction; these relationships exist between individuals who set, interpret, enact, and enforce formal contracts (Sorenson and Rogan 2014). As pointed out by Canales and Greenberg (2016), 'relational contracts minimize the limitations of formal contracts through more flexible structures based on the trust that develops between parties with an economic interest in repeated exchange', p. 1202. Relational contracts derive value from personal relationships between the counterparts, and not, as it would happen in formal contracts, from the rights and responsibilities specified ex ante to reduce the risk of defection. Therefore, they have a greater relevance in complex settings where it is difficult to anticipate the myriad of ex post contingencies that may arise, rendering formal contracts incomplete, difficult to craft, and costly to enforce (Williamson 1985).

For this reason, microfinance constitutes a prototypical setting where formal contracts rarely work (Canales and Greenberg 2016). MFIs focus on the less affluent borrowers who frequently have no credit records or collateral assets. These micro-entrepreneurs are particularly vulnerable to macroeconomic shocks and natural disasters due to their small size and strong dependence to agricultural activities (Quayes 2015). Conversely, relational contracts acquire relevance in microfinance since loan officers grant loans predominantly on the basis of the social capital of the applicants (Ansari et al. 2012). The absence of credit history of the applicants means that loan approval decisions are based on information that is tacit, non-codifiable and can be fully understood only by those who have direct knowledge of the socio-economic environment where borrowers operate or can more effectively source the necessary knowledge. Therefore, the success of loan officers (that is, lending to subjects who will repay the loan) is strongly related to their ability to collect private and soft information in relation to the applicants, and transform this data into a robust estimation of the probability of default of borrowers.

Furthermore, in microfinance loan repayment rates are influenced by the ability of loan officers to create close interpersonal relationships with the borrowers which enable them to discipline and monitor borrowers. Unlike traditional banking, in microfinance loan repayment rates depend more on disciplining and monitoring borrowers rather than carrying out quantitative risk assessments based on estimations of the cash flows that borrowers will be able to generate. Accordingly, given that in microfinance soft information is concentrated on the borrower side, MFIs often use lending groups

where borrowers –under the leadership of loan officers – guarantee, monitor, and discipline each other (Quidt et al. 2016). In other words, the moral influence that loan officers can wield on borrowers is the key factor that enables loan officers to ensure (and enhance) loan repayment rates.

In support of this theoretical perspective, we also draw from the study of Buttner and Rosen (1988) who recognize that a critical part of the loan officer's job is relational, in the sense that it relies on interpersonal interactions with borrowers on the basis of limited information. In this environment, emotional, behavioural and cultural factors drive loan officers' assessment of borrower creditworthiness, complementing (or even overruling) traditional sources of financial information such as borrower affordability. It is worth re-emphasizing that in microfinance there is an almost complete absence of hard information like financial statements and so forth.

A further key point suggested by prior research is that human behaviour in contractual relationships varies depending on the gender of the counterpart (Dufwenberg and Muren 2006). Microfinance is, incidentally, an industry with a heavy female representation (unlike the rest of the financial sector) (Chakrabarty and Bass 2014a). This implies that if gender has a particular role in relational contracts, it derives that in a female-oriented[2] industry such as microfinance there is likely to be a performance differential between female and male loan officers. Furthermore, MFIs mostly operate in developing countries, which are traditionally male-dominated societies. In these societies, women have an historical, entrenched inferior standing in relation to men, usually perpetuated through processes of socialization that reproduce disparities between the two genders (Andersen et al. 2013; Gneezy et al. 2009). Thus, male loan officers potentially possess a stronger standing vis-à-vis borrowers and are, therefore, capable of exercising a more effective monitoring and, hence, disciplining borrowers in arrears. Seen from the opposite perspective, this means that female loan officers are likely to perform less well than their male counterparts because they face (developing) country-specific societal barriers in the exercise of their monitoring duties and in the enforcement of sanctions on male borrowers.

[2] The target market of the microfinance industry is predominantly the female population (Agier and Szafarz 2013a), in our sample, on average, 68% of borrowers are female. Additionally, unlike the traditional banking industry where female representation in leadership and decision-making positions is marginal (Jäkel and Moynihan 2016), women in executive positions within MFIs reach, on average, 29% of the workforce for female managers and 32% for female loan officers (for more details, see Table 2).

Accordingly, Siwale (2016) finds that greater societal pressure is exercised on female loan officers in comparison to their male counterparts, potentially making them less suitable for this role in the microfinance sector. Previous research has also noted that female loan officers are generally more submissive and their authority can be publicly challenged whenever they are regarded to be breaking unspoken and implied femininity rules (Kosny and MacEachen 2010). For example, aggressiveness in loan collection is considered an efficient strategy, but this is also perceived as an expression of masculinity, and thus not expected from female loan officers (Siwale 2016). Second, there are also labour-related (or work-family) reasons that may justify the lower performance of female loan officers. The extant literature shows that the effectiveness of loan officers increases by means of establishing relational contracts with the borrowers and by acting as decentralized lending organisations (Petersen and Rajan 1994). However, building relational contracts is a time-intensive activity, which can potentially disincentivise women from working as loan officers due to their responsibility for childcare and domestic work (Van der Lippe 2007).

Therefore, the opportunity of female loan officers to screen and monitor their loan portfolio will be more limited than their male counterparts, ultimately resulting in a higher credit risk, one of the most important performance criteria for lenders. Accordingly, our first hypothesis states that:

Hypothesis 1: A greater representation of women in loan officer positions of MFIs leads to higher loan portfolio risk.

Nonetheless, we have previously hinted at the fact that one of the pitfalls of the extant literature consists of exclusively looking at the supply side of the lending process. Thus, to achieve a deeper understanding of the effect that female loan officers have on loan portfolio risk, one should also consider the gender of borrowers since other studies find that: (i) the existence of gender affinity - defined as a bias to increasing the granting of (micro) loans between same gender counterparts (Agier and Szafarz 2013b) - between female loan officers and female borrowers which fosters relationships of trust between individuals of the same gender, and (ii) female borrowers have higher loan repayment rates (d´Espallier et al. 2011). The combination of these two sets of assumptions logically leads to conclude that a higher percentage of female borrowers lowers portfolio credit risk.

Cornell and Welch (1996) argue that 'for a given assessment procedure the measurement error for a given evaluator is smaller when the people being considered have a similar cultural background', p. 544. This has intuitively consequences for loan officer decisions as it implies that within the lending application process, the affinity between female loan officers and female borrowers will make the final evaluation less prone to erroneous decisions. Moreover, Ross and Yinger (2002) suggest that loan officers provide more advice to applicants who belong to the same ethnic group as them. In a similar vein, Dymski (2006) claims that the lack of cultural affinity may hurt minority credit applicants. This discrimination towards minorities is also enhanced by loan officers' experiences, as they appear to select borrowers according to their common, gendered experiential (social, economic and cultural) background (Dymski 2006).

Additionally, social preference perspective points out that, due to their greater altruism (Güth et al. 2007) and inequality aversion (Bolton and Ockenfels 2000), women are more sensitive to social cues in determining appropriate behaviour (Gilligan 1982). Being the social preferences of women more situationally specific than men, they will be more likely to have mutual respect and be willing to help other individuals with similar attitudes towards society, that is, other women (Croson and Gneezy 2009). Similarly, it has been shown that due to gender solidarity, female loan officers seem to ask less frequently female borrowers for loan collaterals (Bellucci et al. 2010).

A further factor that could explain the propensity of female loan officers to lend to female borrowers is extrinsic monetary and career-related incentives. Beisland et al. (2019) find that more experienced credit loan officers execute less risky loan transactions, avoiding granting loans to young or disabled borrowers. Thereby, more experienced credit officers try to reduce the approval rates of potentially troubled micro credits given that the remuneration of loan officers is often adjusted to the default rate of the managed loan portfolio. Consequently, female loan officers will prefer granting loans to women since female borrowers are more likely to repay their debts (Aubert et al. 2009). A higher loan repayment rate has also medium and long term professional implications (for example, status recognition, adequacy to the role, among others) for a loan officer, as her career advancement will depend on how effectively the loan portfolio is managed.

Based on the extant research, we, consequently, assume the existence of a gender driver between women acting on both supply and demand sides of the lending process. This driver, which we term as *gender affinity*, will encourage and enhance collaboration between women involved in lending operations. This greater collaboration through gender affinity will lead to higher rates of loan granting from female loan officers to female borrowers. We, therefore, expect a positive relationship between the proportion of females in loan officer positions and the representation of women in the borrowers' population of MFIs, which leads to our second formal hypothesis:

Hypothesis 2: In MFIs there is a positive relationship between the percentage of female loan officers and the percentage of female borrowers.

Following the assumptions underpinning the previous hypothesis, the next step involves confirming whether women effectively entail better borrowers than their male counterparts in terms of repayment rates given that they will be more likely to be granted a loan by a female loan officer. Crucially, the microfinance literature consistently shows that a specific focus on the female population not only provides MFIs with a better corporate reputation due to higher social impact, but also reduces their loan portfolio risk due to lower default losses (d´Espallier et al. 2011). These higher repayment rates of female borrowers are then linked to a number of factors, with the most relevant one being the social capital of female borrowers since this softens the moral hazard and adverse selection problems. As previously stated, since microfinance is considered a trust intensive sector (Duarte et al. 2012), social capital is traditionally used as the sole loan guarantor (Ansari et al. 2012).

Social capital is believed to be generated by three mechanisms: expectations of trusts embedded within social content that overlaps economic relations; formation of groups and accumulation of formal rules and expectations for potential borrowers; and interactions between individuals in need of credit focused on maintaining an acceptable and compliant social behaviour in the group (Sanyal 2009). Social capital is, consequently, enhanced by the process of group participation and interaction, and a social penalty can be imposed on individuals who do not meet their commitments (Quidt et al. 2016). As a result, some authors (Feigenberg et al. 2013) suggest that the presence of social capital leads to a reduction of MFIs´ default risk. Accordingly, Postelnicu and Hermes (2016) hypothesise that the success of microcredit programmes depends on the social capital that borrowers can bring into

the contract and find that MFIs obtain higher financial and social performance in societies which are more conducive to social capital.

Additionally, it has been noted that social capital is generated and used principally by women due to the greater effectiveness of female networks as collateral for loan repayments (Sanyal 2009). As claimed by Maclean (2010), social capital is traditionally women's capital because in the presence of gendered barriers to accessing economic capital, the role played by women in the family and the community at large increases their capability of successfully building and maintaining strong networks. Similarly, Reficco and Márquez (2009) posit that social capital works more effectively in the countries where MFIs traditionally operate, where the use of social capital as a collateral on loans leads to a greater negative impact on the personal reputation and social standing of the borrower than the financial consequences of defaulting following non-repayments of the (micro) credits (Woolcock 2001).

Another factor that explains the higher repayment rates of female borrowers is greater social pressures on women. In the literature it is noted how in credit groups women are more likely to be positively influenced (in terms of keeping up with repayment commitments) by peer pressure (Goetz and Gupta 1996). Similarly, Croson and Gneezy´s (2009) argue that women are more socially malleable, and thus more reactive and positively motivated by the interventions of loan officers. Moreover, female borrowers tend to stay closer to home with their business activity and can, therefore, be more easily monitored by MFIs (Armendáriz and Morduch 2010).

Finally, especially in developing countries female entrepreneurs have fewer credit opportunities and so they have to scrupulously comply with payment deadlines if they want to maintain access to the credit market (Armendáriz and Morduch 2010). Lenders tend to justify their discriminatory practices towards female borrowers in that women are more likely to be involved in smaller businesses and to sacrifice their professional success by prioritizing family obligations (Barbato and De Martino 2003; Danes et al. 2007). However, there is no robust evidence showing that female entrepreneurs underperform male counterparts in managing small businesses (De Bruin et al. 2007). As such, there are strong reasons to expect that lending to women will benefits MFIs as this will likely decrease their loan portfolio credit risk:

Hypothesis 3: There is a negative relationship between increasing lending to female borrowers and the loan portfolio credit risk of MFIs.

Following on the previous hypotheses, it seems logical to derive that the gender driver between female loan officers and female borrowers will have crucial implications for the loan portfolio quality of MFIs. As mentioned earlier, gender affinity implies that female loan officers will be more likely to lend to female borrowers. In turn, female borrowers will be more successful with loan repayment rates. The *full* effect of greater female representation on both sides of the lending process will consequently reduce further the loan portfolio credit risk of MFIs. Essentially, we hypothesize a double virtuous effect of gender affinity.

First, as stated in H_2, gender affinity will directly increase lending opportunities for female borrowers in developing countries, where access to credit is notoriously more difficult for women. Second, the indirect effect of gender affinity will be a lower risk loan portfolio for MFIs due to a greater presence of female loan officers. As stated by Beck et al. (2013), 'loan officers might have an easier time building a trust relationship and exploiting monitoring opportunities with borrowers of their own gender, which is assumed to generate a lower arrear probability of female borrowers if the loan is approved and monitored by a female rather than by a male loan officer, with the reverse holding for male borrowers', p. 1280. This is highly beneficial for MFIs, as gender affinity will improve the capability of lending institutions to meet their social (serving more women) and financial (reducing loan default rates) goals. Formally, our final hypothesis states that:

Hypothesis 4: The impact of female loan officers on loan portfolio credit risk of MFIs is negatively mediated by the percentage of female borrowers.

3. Data

3.1. Data Description

To build the database used in this study, information was collated from three different data sources. First, as customary in the microfinance literature (Chiu 2017; Bogan 2012), the data on MFIs was collected from the World Bank's Microfinance Information Exchange (MIX), a global information platform that contains both financial and operational information on MFIs. Second, country level macroeconomic data related to gross domestic product per capita (in US dollar and percentage annual

growth) and inflation rate were extracted from the World Bank databases. Third, we also accessed the United Nations Development Programme data (UNDP data) to gather the Gender Inequality Index (GII) (Gaye et al. 2010), which measures the gender-based gap in accessing resources and opportunities at the country level.

Only cases related to MFIs with audited data (four and five diamonds in the MIX Market dataset) were selected and, after excluding outliers, an unbalanced panel data sample was generated with 1,018 MFIs observations covering developing countries across the world for the five-year period 2010-2014. Table 1 reports a detailed descriptive analysis of the sample per region and country. As shown, the MFIs observations corresponded to 52 developing countries distributed across six geographical regions: Africa (2.06 percent), East Asia and the Pacific (7.57 percent), Eastern Europe and Central Asia (17.88 percent), Latin America and The Caribbean (40.57 percent), Middle East and North Africa (2.55 percent), and South Asia (29.37 percent). The high percentages of South America and South Asia are related to the historical importance, institutional public support and exponential growth of microfinance in these areas. Accordingly, a considerable number of MFI cases were associated with countries such as Nicaragua (61), Bolivia (60), Tajikistan (38) or India (169). Moreover, these figures reflect the relatively low relevance of microfinance in Africa and the Middle East.[3]

[INSERT TABLE 1 HERE]

Table 2 reports the descriptive statistics for several key performance ratios of MFIs in our sample. Accordingly, the gross loan portfolio of MFIs is, on average (median) of 51 million (11 million) US dollar, which is growing, in terms of number of borrowers, by an impressive 15 percent on annual basis. 56 percent (57 percent) of customers are located in rural areas and 68 percent (68 percent) of these are women. With respect to MFIs financial ratios, our sample suggests an average leverage ratio standing at 4.23 (3.26) and a loan portfolio credit risk as measured by the write-off ratio of 0.02 (0.01) and 0.05 (0.03) in terms of portfolio not-overdue for more than 30 days (PaR30). Finally, at the country level the average inflation rate stands at 6.20 percent (6.04 percent) and the gross domestic

[3] The importance of the microfinance sector in Tajikistan has substantially grown after the promulgation of the first Law of Microfinance in 2004. This legislative intervention was particularly helpful in increasing entrepreneurship activities since it provides an institutional framework for developing microfinance activity on the basis of a sustainable business model.

product (GDP) per capita grows by 3.91 percent (4.16 percent) annually. In Appendix A we report the correlation matrix of the variables used in the study.

To quantify the failure rate of loans several ratios can be used. A first approximation consists with measuring the proportion of loans overdue by more than *x* days with respect to the gross loans granted- the so-called portfolio at risk (PaR). In this study, we use *x=30* since, as sustained by D'Espallier et al. (2011), when loans are overdue by at least 30 days or more this generates considerable costs for lending institutions. However, given that a loan overdue does not imply that it will not be repaid in the future, a more appropriate variable to measure the loan portfolio credit risk consists of considering as non-performing loans only those loans that the lender has removed from its accounting records because of a substantial doubt that they will be recovered in the future – namely the write-off ratio. The write-off ratio is calculated by dividing total write-offs for the period (i.e. loans removed from financial accounts of lenders) by the period's average gross loan portfolio. Therefore, we use write-off ratio as dependent variable in the main analysis and employ the portfolio at risk by more than 30 days (PaR 30) as dependent variable in the robustness tests.

[INSERT TABLE 2 HERE]

3.2. Methodology

To test the hypotheses formulated, we used a random effect panel data estimation model for the regression analysis where loan portfolio risk (measured in terms of write-off ratio) is regressed on the percentage of women in loan officer position and as borrowers, controlling for both firm and institutional-country effects. A panel data approach allows to control for possible unobserved heterogeneity (that is, the existence of time-invariant explanatory variables which are not observed but correlated with the observed explanatory variables). It investigates within-firm variations in the loan portfolio credit risk where the individual specific effect is a random variable that is uncorrelated with the explanatory variable of all past, current and future time periods for the same MFI. A random effect estimation controls for serial correlation in the error term and assumes a constant variance of the individual specific effect. Therefore, we employ the following general panel data model:

$$y_{i,t} = \beta_0 + \beta_1 WLO_{i,t} + \beta_2 WB_{i,t} + \beta_i X_{i,t} + u_{i,t}$$

where the *i* subscript denotes the cross-sectional dimension and *t* the time-series dimension. The dependent variable, y_{it}, is the annual write-off ratio, used as measurement of loan portfolio risk, WLO_{it} and WB_{it} respectively measure the percentage of women loan officers and borrowers, X_{it} is the vector of the control variables of a MFI *i* at time *t*, and u_{it} is the error term. The matrix of the control variables (X_{it}) includes two types of variables. First, it incorporates MFI-specific variables such as depth and breadth of outreach, whether the lending activity is carried out in rural areas, quality of technical assistance offered to borrowers-entrepreneurs, profit orientation, ownership structure, size, leverage and level of operational sustainability. Second, country-level variables capture the social, institutional and macroeconomic environment of the country where a MFI operates as these have been found to markedly impact on credit risk and default losses of firms (Chen 2010).

Special attention should be paid to the expected effect of outreach-related control variables due to the social idiosyncrasy of the microfinance industry, as they will have repercussions on the overall credit risk of MFIs. Three proxies for MFI outreach were introduced in our models: depth of outreach, breadth of outreach and percentage of loan portfolio in rural areas. First, we used loan size as proxy for the depth of outreach (or level of socio-economic exclusion) since smaller loans are associated with a greater depth of outreach (Hermes et al. 2011; Quayes 2015). Female borrowers are also more likely to apply for smaller loans (Armendáriz and Morduch 2010). Furthermore, Kowalik and Martinez-Miera (2010) find that MFIs serving individuals from rural areas and, more specifically, women from those rural areas, are those with higher repayment rates. The traditional banking literature (and also economic logic) posits that higher income generation results in better loan repayment rates. Within microfinance, it is recognized that, despite being widely used, the hypothesized correlation between loan size and poverty is far from precise (Agier and Szafarz 2013b). On the one hand, some authors argue that reaching the poorest in society carries a cost, essentially causing worse financial performance due to higher default losses and screening, monitoring and enforcement costs (Mersland and Strøm 2010; Cull et al. 2007; Hermes et al., 2011; Morduch, 2000). Conversely, another perspective argues that lending to people on the bottom of the pyramid (BoP) decreases information costs, adverse selection, and moral hazard and increases the use of social collateral (Woolcock 2001).

Second, we controlled for loan portfolio growth, that is, for the change in the number of customers of an MFI. This measures the scope of MFIs´ activity and thus proxies their market share. Expanding the customer base is a key objective of most for-profit firms (Aghion and Stein 2008), and banks often assess their relative performance against their competitors on this basis (Berger and Bouwman 2013). The traditional banking literature sustains that loan portfolio growth represents a relevant driver of the riskiness of banks (Foos et al. 2010), as banks seeking to increase their market share might relax their screening standards leading to a larger number of defaulted loans (Dell'Ariccia and Márquez 2006). Nevertheless, the microfinance literature (see, for instance, Yimga 2016) consistently shows a negative effect of loan portfolio growth on the credit risk of MFIs. This may be explained by the fact that the risk effect of diversification is greater when smaller loans are granted to a larger number of borrowers, as it is normally the case in microfinance.

Third, greater focus on the rural population is one of the most widely used outreach indicators because the rural population generally suffers to a greater extent socio-economic underdevelopment and less advanced societal rules, with women especially affected from this situation (Duflo 2012). Indeed, formal financial intermediaries do not often serve rural borrowers since these are less profitable and riskier than urban clients. This is in part linked to the characteristics of the economy of developing countries, which is mainly based on agriculture, and hence more exposed to uncontrollable disaster risks and with a limited capacity for reinvestment (Khavul et al. 2013). Thus, the population from rural areas is excluded from traditional banking and therefore a target market of MFIs. To measure this, we use the percentage of the gross loan portfolio granted in rural areas. Previous studies have suggested that microcredits lent to rural communities have better repayment rates than those granted in urban areas and this may be explained by a higher effectiveness on the rural population of enforcement mechanisms such as loan officer monitoring and social and peer pressures (that is, the social collaterals) (Baele et al. 2014). Furthermore, the socio-institutional context is captured by the gender inequality index (GII) (Gaye et al. 2010), which is a proxy for the level of integration and equality that women have in a society. In this study, the macroeconomic situation of the country is measured by means of the GDP per capita (both in US dollar and as annual growth) and the inflation rate. Additionally, the loan portfolio risk borne by a MFI is likely to be affected by previous risk

levels: that is, there is an inter-temporal effect due to the credit risk at time *t* being dependent on the risk at time *t-1*. Consequently, we re-estimated our model by introducing the lagged write-off ratio as control variable.

Although this study is primarily focused on soft information linked to the gender driver, we include several control variables to capture hard information such as: (i) financial ratios (assets, debt to equity ratio and operational self-sufficiency), (ii) organisational variables (number of borrowers per each loan officer) and (iii) macroeconomic variables (growth rates of inflation and GDP per capita).To better account for the possibility of lagged effects, we employed panel corrected standard errors (PCSEs) estimations to handle possible contemporaneous correlation of the errors (that is, being correlated across firms within the same time period) and heteroscedasticity (that is, having unequal variances across different subsets of MFIs). In a panel data design, error terms may not be independent among different time periods resulting in a possible serial correlation problem (Hicks 1994). This means that for each individual MFI the association between independent and dependent variables in the last year of analysis could be driven by (or at least being correlated with) the relationship between variables in the previous year and so forth. Hence, through PCSEs we also obtained estimations with lagged dependent variables as controls. Furthermore, to deal with the serial correlation and potential omission of control variables (selection bias) problems at the same time, we adopted (two-steps) Arellano-Bond dynamic panel data model Generalized Method of Moments (GMM) estimator (Windmeijer 2005), *xtabond2*.

$$y_{i,t} = \beta_0 + \rho y_{i,t-1} + \beta_1 WLO_{i,t} + \beta_2 WB_{i,t} + \beta_i X_{i,t} + u_{i,t}$$

Additionally, as suggested by the gender literature (Srinidhi et al. 2011) the relationship between the proportion of women loan officers and loan portfolio risk may be affected by endogeneity (Verbeek 2008) and reverse causality concerns. To address such problems, we used a two-stage least squares regression. As sustained Larcker and Rusticus (2010), this method requires the inclusion of instrumental variables (IV) which must be exogenous, that is they must be determined outside of the model and not correlated with the error (exclusion condition), unrelated to the dependent variable (loan portfolio credit risk) and satisfy the relevance condition, that is to be significantly correlated to the endogenous variable (female loan officers). Under these conditions, two instrumental variables

were considered in the present study: (i) the percentage of female managers and (ii) a dummy variable that takes value 1 for those MFIs that mobilize savings products (mainly deposits) and 0 otherwise. In relation to the first instrumental variable, previous research (Huffman et al. 2010) finds that firms with higher proportion of female managers are more gender-integrated at all organizational levels. Therefore, female representation in manager and loan officer job positions are theoretically positively related. Second, unlike MFIs that do not offer saving deposits, deposit-taking MFIs are licensed as traditional banks and hence are regulated by guidelines enacted by national financial regulatory authorities (Cull et al. 2011). Indeed, only regulated MFIs can commercialise saving-deposit products (Bogan 2012). In order to collect deposits, MFIs must meet strict entry capital requirements (Hartarska et al. 2013). That is, MFIs that offer saving deposits have higher levels of institutional constraints and regulatory demands to deal with. They also have a greater degree of voluntary regulatory compliance such as the so-called codes of good governance, which require firms to follow socially responsible behaviours, including pursuing gender equality, which translates into being positively associated with higher representation of women in loan officers' position.

Finally, to test H_4 assumption that the gender of borrowers mediates the relationship between female loan officers and loan portfolio credit risk, we used seemingly unrelated regressions (SUR) for panel data (Zellner 1962). This methodology is based on a set of equations that has contemporaneous cross-equation error correlation, that is, the error terms in the regression equations are correlated. In practice, the main advantage of the SUR estimator is that it accounts for contemporaneous correlations and allows the *p* dependent variables to have different sets of explanatory variables.

4. Results

4.1. Main results

The first set of regressions focused on analyzing the impact that female loan officers and female borrowers have on loan portfolio risk of MFIs (results presented in Table 3). To increase the reliability and robustness of our results, alternative panel estimation models - pooled ordinary least squares, fixed effects regression (FE-R) and random effects generalized least square (RE-GLS) - were performed (models 1-3). Additionally, to deal with the inter-temporal effect of credit risk, serial correlations and

selection bias problems, the linear regression with PCSEs and two-step GMM estimator were used (models 5-6).

As can be seen in Table 3, the findings revealed that a higher representation of women in loan officer positions is significantly and positively related to a riskier loan portfolio. This influence of female loan officers on portfolio risk remains consistent in all estimation models. To run the analysis, we chose a panel data specification with random effects given that several control variables were time-invariant. The Hausman test also suggested that this was the most appropriate approach (18.37, *p*-value = 0.1441). Our confidence in the reliability of the findings was enhanced by the qualitatively similar results obtained through PCSEs and GMM estimations. Confirming hypothesis H_1, these results indicated that, at first glance, women appeared to perform worse than men in loan officer jobs. Conversely, our results contradict what Beck et al. (2013) found in the banking industry since their study suggests that female credit officers are better, in terms of decrease the loan portfolio credit risk, than male counterpart.

A further set of results (see Table 3) showed that, as predicted, female borrowers are significantly and positively associated with a reduction in MFIs´ credit risk. Confidence in this finding is heightened by the fact that the results remained consistent across all estimation models performed. Therefore, confirming H_3 and in line with extant microfinance literature (d´Espallier et al. 2011), our findings revealed that a higher ratio of female borrowers seem to reduce the loan portfolio risk of an MFI due to their higher re-payment rates.

[INSERT TABLE 3 HERE]

To fully understand the impact of gender on MFIs´ loan portfolio credit risk, we tested the existence of a gender driver in the credit loan market underpinning trust and personal relationships among women located on both sides of the lending process (H_2). As shown in Table 4 and confirming H_2, we found a significant and positive relationship between female loan officers and female borrowers. Hence, this finding supports the assumption of a gender affinity driver within the microfinance industry which leads to female loan officers approving more loans to female borrowers.

[INSERT TABLE 4 HERE]

Finally, to test H_4, namely the *full* gender affinity effect on the loan portfolio risk of MFIs, we investigated the potential mediating role that female borrowers potentially have on the relationship between female loan officers and MFIs credit risk. As reported in Table 5 and Figure 1, we observed a more nuanced influence of female loan officers on portfolio credit risk. On the one hand, there is still a positive *direct* effect of the gender of the loan officer on (higher) portfolio credit risk (coefficient 0.2302, *p*-value 0.0000). This effect further confirms H_1 as it remains unaltered by applying SURs. Nevertheless, we also crucially found a negative *indirect* (or mediating) impact of female loan officers on the loan portfolio risk via female borrowers. The mediating effect indicated that a greater presence of female loan officers effectively improves the loan portfolio quality by reducing the credit risk of MFIs. Therefore, female borrowers act like a suppressor variable on the relationship between female loan officers and credit risk of MFIs (Conger 1974), as an increase in the percentage of female loan officers has a negative (mediated) effect – reducing the risk - on loan portfolio credit risk given that they are more likely to lend to female borrowers. The latter, as we saw earlier, are overall better are repaying their debts. In sum, the mediating impact via gender affinity between women on the opposite sides of the lending process substantially decreases the loan portfolio risk of MFIs.

To test the robustness of the mediating analysis, we re-estimated SURs by employing as dependent variable another credit risk measure widely-used in the literature (d´Espallier et al. 2011): portfolio at risk for more than 30 days (PaR 30). PaR 30 measures the portion of the loan portfolio at risk of not being paid after a certain period; that is, the outstanding balance of all loans with arrears over 30 days plus all refinanced or restructured loans. As shown in Table 5 and Figure 1, the robustness tests confirmed the previous findings, as the observed relationships remain unchanged. Thus, following our expectations, we find that in the microfinance industry there exists a gender driver spanning across both sides of lending transactions that reduces the loan portfolio credit risk.

[INSERT TABLE 5 HERE]

[INSERT FIGURE 1 HERE]

4.2. Robustness Test

As previously explained, we attempted to deal with the potential endogeneity problems that may arise in the relationships among female loan officers and portfolio risk of the MFIs through IVs estimation.

Table 6 shows the result of the two-stages least square regressions. As reported in Table 6, the results confirmed the negative (direct) effect of greater proportion of female loan officer on portfolio credit risk (H_1) and also supported the existence of a gender affinity driver, that is, that female loan officers tend to lend more to female borrowers (H_2). Hence, these results re-affirmed the robustness of the previous findings and the overall implications of this study.

[INSERT TABLE 6 HERE]

5. Discussion and Conclusion

This study analyses the impact of gender on loan portfolio credit risk in the microfinance, a socially oriented industry targeting micro-entrepreneurs in particular in developing countries. It was noted that, to date, only limited attention has been given to the potential gender-driven affinity between women acting on both sides (that is, as loan officers and borrowers) of a lending transaction. This knowledge gap is particularly significant in microfinance where the relationships between lenders (loan officers) and borrowers (micro-entrepreneurs) and loan approval decisions are dominated by relational contracts (*soft* data) given the severe lack of financial information and absence of credit history of the target population. Our aim was to study the overall effect of gender on both sides of lending operations by looking at its influence on the credit risk of loans granted by MFIs. We choose to focus our analysis within the settings of microfinance because this is a lending market where there exists a specific focus on female micro-entrepreneurs due to the social impact commitment of MFIs. Therefore, this was seen as an ideal case study as it allowed us to analyse the effect of gender in socio-economic and entrepreneurship environments where women are generally in a disadvantaged position in comparison to men, both in terms of exerting authority while carrying out their functions as loan officers and in having access to the credit market.

First, we found that a greater representation of women in loan officer positions increases the loan portfolio credit risk of MFIs. This result is in line with previous research showing that gender matters for performance of lending institutions (Beck et al. 2013; García-Meca et al. 2015). However, our study contributes to this literature by highlighting how the overall impact of gender on the performance of MFIs in terms of credit risk is positive, and this is due to the mediating effect of female micro-entrepreneurs (borrowers). Put it differently, our results show that in economic terms the

gender effect on the credit risk of MFIs is, on the whole, *positive*. Thus, although the initial findings appear to suggest that female loan officers increase the loan portfolio risk, they do not take into account the fact that female loan officers are related – due to what we have termed as gender affinity - to a higher percentage of female borrowers, and the latter are normally better at repaying their debts than male borrowers. These findings are clearly beneficial for MFIs as the existence of this gender affinity driver allows lending institutions to meet their social goals - serving women micro-entrepreneurs who are at the bottom of the social pyramid - and their financial objectives – reduction in loan default rates by lending to better borrowers - and, in the process, improve their corporate reputation.

Furthermore, gender affinity operates as a catalyst for social, cultural, institutional, emotional and behavioural factors (that is, *soft* information) that influence loan approval decisions, and consequently, the availability of credit for micro-entrepreneurs. In other words, our findings suggest that loan-approval decisions are gender-dependent, and therefore funding availability increases when the gender of the entrepreneur matches with the gender of the loan officer. That is, we find that in microfinance lending transactions are gender biased. These results support the belief of some authors (for instance Dufwenberg and Muren 2006) suggesting that people's behaviour in contractual relationships varies depending on the gender of the counterpart. Furthermore, these findings also follow the thesis of Bellucci et al. (2010) suggesting that 'female officers appear to exhibit some solidarity with female borrowers as they ask them for collateral less often', p. 2979, which ultimately makes access to credit easier. Moreover, our research confirms and integrates previous findings in the literature on the positive gender impact of borrowers on portfolio credit risk (d´Espallier et al. 2011). Conversely, our findings are in contrast with the findings of Agier and Szafarz (2013b), who find no gender bias in approval loan rates.

With reference to potential explanations of the gender affinity drivers, it appears reasonable to assume that, as MFIs mainly operate in socio-economic heavily excluded areas, female loan officers are likely to favour lending to female borrowers because the latter can be more easily monitored and disciplined than men due to existing societal barriers. Furthermore, women have been found to possess greater social altruism and inequality aversion; the greater moral responsibility that generally drives a

woman behaviour implies greater propensity for cooperation and empathy with more disadvantaged borrowers (Gilligan, 1982). In microfinance, this is particularly relevant because lending institutions aim to serve more socially-excluded individuals (Agier and Szafarz 2013b). Female borrowers are also more receptive to peer pressure (Goetz and Gupta, 1996) and have higher rate of attendance at meetings with MFIs and solidarity loan groups (Ameen 2004), which makes them more likely to repay the loan (and thus a more appealing customer for loan officers).

Our results have also relevant implications for both scholars and practitioners. From the perspective of the former, due to the asymmetric information problems caused by the lack of financial information available and credit history for venturing businesses, our results highlight relational contracts and soft information as crucial factors in funding micro-entrepreneurs. Accordingly, we suggest that more attention should be paid on the affinity and mutual trust that arise between women given that this acts as a catalyst of soft data, both internal and external of the organizations that fund micro-entrepreneurs. From a practical point of view, there are clearly important implications in relation to human resource policies in MFIs and lending institutions in general since we find that loan approval decisions are gender-influenced. Accordingly, supporting the trend aiming at providing women with greater opportunities in managerial and decision making roles, our findings suggest that greater female presence is beneficial not only in terms of equity concerns (closing the gender gap) but also with regard to the bottom line of organizations, whether they are for profit driven or belong to the third sector. For MFIs, this is particularly significant as providing credit to BoP people (including women) is one of their main institutional raison d'être.

Furthermore, although the findings reported here can be generalized to other organizational contexts, it would be useful if a similar line of research was repeated in relation to mainstream financial institutions where, as previously explained, the presence and role of women in managerial and technically-oriented positions is still below expectations. Male dominance in this industry is based on arguments built on far reaching conclusions of gambling studies showing, for example, the assumed lower ability of women in financial matters. Similarly, it would be important to know whether gender affinity has an analogous impact on other measures of performance beyond credit risk. Does gender affinity lead to higher profits? Is it a positive force in support of more socially-oriented

goals? Does it play a role in terms of increasing the ethical awareness and responsibility of firms? Moreover, our study has focused on the impact of gender in developing countries but it would be worth exploring whether similar results were obtained by focusing on more mature economies and countries with less pronounced social inequalities. Finally, drawing from the extant literature, we have put forward a number of theoretical explanations for the reported findings, but, clearly, more needs to be done to fully understand *what* underpins gender affinity and *why* it is related to lower portfolio credit risk levels. Essentially, a qualitative approach based on in-depth interviews and observations of individuals operating on both sides of lending transactions can more thoroughly explore the nature, drivers and implications of gender affinity.

As far as future research avenues are concerned, we suggest testing the hypotheses proposed in this paper by using more granular data at the loan officer-borrower (entrepreneurs) level. This will allow controlling for the gender impact according to personnel soft and technical skills, business expertise, and educational background, among others information of both sides of loan transactions, that is, as loan officers (supply side) *and* as borrowers (demand side). This represents an important research avenue given that the role of gender in decision making still remains relatively understudied to date in the financial intermediation industry (a sector traditionally male-dominated), in developing countries (where the full incorporation of women in the labour market is still a recent and limited phenomenon), and in the entrepreneurship field (where the role of women is still comparatively unexplored).

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TABLES

Table 1.

Countries in the sample.

Region	Country	Frequency	Percentage	Cumulative percentage
Africa Frequency = 21 Percentage = 2.06%	Benin	3	0.29	0.29
	Kenya	7	0.69	0.98
	Madagascar	1	0.10	1.08
	Mozambique	2	0.20	1.28
	Senegal	1	0.10	1.38
	Uganda	4	0.39	1.77
	Zambia	3	0.29	2.06
East Asia and the Pacific Frequency = 77 Percentage = 7.56%	Cambodia	36	3.54	5.60
	Indonesia	15	1.47	7.07
	Philippines	20	1.96	9.03
	Vietnam	6	0.59	9.62
Eastern Europe and Central Asia Frequency = 182 Percentage = 17.88%	Albania	3	0.29	9.91
	Armenia	23	2.26	12.17
	Azerbaijan	34	3.34	15.51
	Bulgaria	5	0.49	16.00
	Georgia	21	2.06	18.06
	Kazakhstan	19	1.87	19.93
	Macedonia	7	0.69	20.62
	Moldova	2	0.20	20.82
	Mongolia	10	0.98	21.80
	Poland	1	0.10	21.90
	Romania	6	0.59	22.49
	Russia	7	0.69	23.18
	Serbia	1	0.10	23.28
	Tajikistan	38	3.73	27.01
	Turkey	1	0.10	27.11
	Ukraine	4	0.39	27.50
Latin America and The Caribbean Frequency = 413 Percentage = 40.57%	Argentina	13	1.28	28.78
	Bolivia	60	5.89	34.67
	Brazil	10	0.98	35.65
	Chile	4	0.39	36.04
	Colombia	42	4.13	40.17
	Costa Rica	10	0.98	41.15
	Dominican Republic	18	1.77	42.92
	El Salvador	33	3.24	46.16
	Guatemala	42	4.13	50.29
	Honduras	58	5.70	55.99
	Mexico	6	0.59	56.58
	Nicaragua	61	5.99	62.57
	Panama	11	1.08	63.65
	Paraguay	19	1.87	65.52
	Peru	26	2.55	68.07

Middle East and North Africa Frequency = 26 Percentage = 2.56%	Egypt	7	0.69	68.76
	Jordan	3	0.29	69.05
	Lebanon	2	0.20	69.25
	Morocco	12	1.18	70.43
	Tunisia	2	0.20	70.63
South Asia Frequency = 299 Percentage = 29.37%	Bangladesh	43	4.22	74.85
	India	169	16.6	91.45
	Nepal	34	3.34	94.79
	Pakistan	38	3.73	98.53
	Sri Lanka	15	1.47	100
Total observations		**1,018**	**100**	

Table 2.

Descriptive statistics.

Variable	N	Mean	Std. dev.	Min.	Q1	Median	Q3	Max.
Write off ratio	1,018	0.02	0.03	0.00	0.00	0.01	0.02	0.40
Portfolio at risk > 30 days (PaR 30)	1,018	0.05	0.06	0.00	0.01	0.03	0.06	0.42
Gross loan porfolio (in millions)	1,018	51.190	126.936	0.153	3.700	11.000	35.750	466.600
Percentage female loan officers	1,018	0.32	0.27	0.00	0.09	0.25	0.48	1.00
Percentage female borrowers	1,008	0.68	0.25	0.04	0.47	0.68	0.96	1.00
Number active borrowers (percent growth)	1,018	0.15	0.31	-0.65	-0.01	0.11	0.26	2.40
Loan size (average loan balance per borrower)	1,018	1,117.39	1,543.06	73.00	194.00	587.50	1,322.00	12,230.00
Profit status dummy	1,018	0.47	0.50	0.00	0.00	0.00	1.00	1.00
NGO dummy	1,018	0.40	0.49	0.00	0.00	0.00	1.00	1.00
Bank dummy	1,018	0.09	0.28	0.00	0.00	0.00	0.00	1.00
Personnel allocation ratio	1,015	0.46	0.14	0.04	0.37	0.46	0.55	0.89
Percentage gross loan portfolio rural	1,018	0.56	0.29	0.01	0.32	0.57	0.80	1.00
Operational self-sufficiency	1,018	1.17	0.23	0.22	1.05	1.14	1.26	2.41
Ln borrowers per loan officer	1,018	5.54	0.58	3.87	5.23	5.56	5.90	7.50
Debt to equity ratio	1,018	4.23	4.18	0.02	1.63	3.26	5.31	37.20
Ln assets	1,018	16.54	1.66	12.54	15.38	16.39	17.60	21.21
Global gender gap index	1,018	0.67	0.05	0.55	0.65	0.67	0.69	0.79
GDP per capita (percent growth)	1,018	3.91	2.39	-4.70	2.23	4.16	5.23	15.32
GDP per capita current US	1,018	3,535.86	3,187.06	414.14	1,447.45	2,377.71	4,142.87	15,764.76
Inflation consumer price (percent growth)	1,017	6.20	3.16	-1.42	3.79	6.04	8.86	18.68
Gender inequality index	1,015	0.47	0.09	0.15	0.41	0.49	0.54	0.63
Percentage female managers	1,018	0.29	0.26	0.00	0.07	0.25	0.45	1.00
Deposits dummy	1,018	0.38	0.49	0.00	0.00	0.00	1.00	1.00

Table 3.

Effect of female loan officers on loan portfolio risk.

Dependent variable: **Write off ratio**	**Model 1** **POLS**	**Model 2** **FE-R**	**Model 3** **RE-GLS**	**Model 4** **PCSE**	**Model 5** **GMM**	**Model 1** **POLS**	**Model 2** **FE-R**	**Model 3** **RE-GLS**	**Model 4** **PCSE**	**Model 5** **GMM**
First lag of write off ratio				0.0315	-0.0516				0.0476	0.0472
				(0.1473)	(0.1185)				(0.1456)	(0.1042)
Percentage female loan officers	0.0076*	0.0265*	0.0074*	0.0088*	0.0153*					
	(0.0039)	(0.0157)	(0.0041)	(0.0053)	(0.0092)					
Percentage female borrowers						-0.0190***	-0.0114	-0.0193***	-0.0205*	-0.0169**
						(0.0058)	(0.0198)	(0.0060)	(0.0107)	(0.0083)
Number borrowers (percent growth)	-0.0092***	-0.0075	-0.0087***	-0.0055*	-0.0045*	-0.0100***	-0.0069	-0.0095***	-0.0079**	-0.0063**
	(0.0031)	(0.0047)	(0.0031)	(0.0034)	(0.0024)	(0.0032)	(0.0047)	(0.0032)	(0.0039)	(0.0027)
Loan size (average loan balance per borrower) (x '000000)	-1.7600**	-1.4200	-1.6700*	-1.5300	-0.3930	-2.3900***	-1.5100	-2.2700**	-1.9900	-1.6000
	(0.8860)	(2.9900)	(0.9080)	(1.2500)	(1.1900)	(0.9000)	(3.1300)	(0.9260)	(1.3100)	(1.1000)
Profit status dummy	0.0027		0.0028	0.0039	-0.0013	0.0034		0.0035	0.0034	0.0052
	(0.0031)		(0.0032)	(0.0054)	(0.0051)	(0.0031)		(0.0032)	(0.0055)	(0.0044)
NGO dummy	0.0002		0.0005	0.0010	-0.0005	0.0022		0.0025	0.0024	0.0043
	(0.0032)		(0.0033)	(0.0056)	(0.0047)	(0.0032)		(0.0034)	(0.0057)	(0.0045)
Bank dummy	0.0038		0.0039	0.0070	0.0043	0.0020		0.0021	0.0047	-0.0028
	(0.0041)		(0.0042)	(0.0076)	(0.0068)	(0.0041)		(0.0043)	(0.0070)	(0.0055)
Personnel allocation ratio	-0.0187**	0.0392*	-0.0174**	-0.0202*	-0.0228*	-0.0070	0.0344	-0.0054	-0.0086	-0.0045
	(0.0084)	(0.0207)	(0.0086)	(0.0121)	(0.0125)	(0.0091)	(0.0210)	(0.0093)	(0.0109)	(0.0132)
Percentage gross loan portfolio rural	0.0001	0.0153*	0.0002	0.0006	0.0254	-0.0020	0.0128	-0.0018	0.0001	-0.0189
	(0.0037)	(0.0091)	(0.0038)	(0.0053)	(0.0300)	(0.0036)	(0.0092)	(0.0037)	(0.0052)	(0.0190)
Operational self-sufficiency	-0.0194***	-0.0277***	-0.0199***	-0.0174***	-0.0363	-0.0198***	-0.0264***	-0.0205***	-0.0192***	-0.0210
	(0.0044)	(0.0087)	(0.0045)	(0.0059)	(0.0349)	(0.0045)	(0.0087)	(0.0045)	(0.0057)	(0.0158)
Ln borrowers per loan officer	-0.0080***	0.0099	-0.0077***	-0.0079**	-0.0103**	-0.0060***	0.0074	-0.0056**	-0.0057	-0.0045
	(0.0021)	(0.0070)	(0.0022)	(0.0039)	(0.0049)	(0.0022)	(0.0071)	(0.0023)	(0.0040)	(0.0040)
Debt to equity ratio	-0.0003	0.0015**	-0.0002	-0.0006***	-0.0009***	-0.0002	0.0013*	-0.0001	-0.0006**	-0.0006**
	(0.0002)	(0.0006)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0007)	(0.0003)	(0.0003)	(0.0003)

Ln assets	0.0003	-0.0103**	0.0003	0.0002	0.0017	-0.0001	-0.0095**	0.0001	-0.0001	0.0006
	(0.0007)	(0.0048)	(0.0008)	(0.0008)	(0.0013)	(0.0008)	(0.0048)	(0.0008)	(0.0008)	(0.0010)
Gender inequality index	0.0219	0.1026	0.0209	0.0306	0.0447	0.0225	0.0955	0.0215	0.0304	0.0242
	(0.0163)	(0.1187)	(0.0170)	(0.0273)	(0.0306)	(0.0163)	(0.1196)	(0.0171)	(0.0293)	(0.0349)
GDP per capita (percent growth)	-0.0012***	0.0002	-0.0012***	-0.0010**	-0.0015*	-0.0011**	0.0003	-0.0010**	-0.0008*	-0.0008
	(0.0004)	(0.0007)	(0.0004)	(0.0004)	(0.0009)	(0.0004)	(0.0007)	(0.0004)	(0.0004)	(0.0005)
GDP per capita current US (x '000000)	0.6570	2.6600	0.6700	0.8520	1.3300	0.7160*	2.4500	0.7160	0.7990	0.4470
	(0.4210)	(2.9800)	(0.4380)	(0.5700)	(0.8560)	(0.4160)	(3.0100)	(0.4370)	(0.5180)	(0.8180)
Inflation consumer price (percent growth)	-0.0009**	-0.0005	-0.0009**	-0.0007*	-0.0004	-0.0005	-0.0005	-0.0005	-0.0004	-0.0001
	(0.0004)	(0.0006)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0006)	(0.0004)	(0.0004)	(0.0004)
Constant	0.0844***	0.0754	0.0811***	0.0784**	0.0669	0.0869***	0.0993	0.0833***	0.0822**	0.0709*
	(0.0154)	(0.0912)	(0.0160)	(0.0322)	(0.0492)	(0.0152)	(0.0909)	(0.0159)	(0.0335)	(0.0393)
Dummy variable year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	976	976	976	728	719	966	966	966	719	719
R-squared (R^2)	0.1035	0.0597	0.1033	0.0893		0.1107	0.0494	0.1105	0.0982	
F-Test/Wald-chi^2	5.51***	2.24***	101.22***	72.89***	53.54***	5.88***	1.82**	107.34***	89.93***	50.24***
Sargan test					3.66					1.29

Note: We report pooled ordinary least square (POLS), fixed effects regression (FE-R), random effects generalized least squares (RE-GLS) linear panel regression, linear regression with panel-corrected standard errors (PCSE) and generalized method of moments estimator (GMM). Standard errors for the slope coefficients are in parentheses. m_2 is a test for second order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Sargan-Hansen test is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. ***p<0.01, **p<0.05, *p<0.1

Table 4.

Effect of female loan officers on female borrowers.

Dependent variable: Percentage female borrowers	Model 1 POLS	Model 2 FE-R	Model 3 RE-GLS	Model 4 PCSE	Model 5 GMM
Lag of percent female borrowers				0.8809***	0.2284
				(0.0267)	(0.2812)
Percentage female loan officers	0.2014***	0.0695**	0.1517***	0.0284***	0.1678*
	(0.0213)	(0.0326)	(0.0241)	(0.0099)	(0.0960)
Number borrowers (percent growth)	-0.0104	-0.0012	-0.0096	0.0209**	-0.0032
	(0.0173)	(0.0098)	(0.0093)	(0.0086)	(0.0152)
Loan size (average loan balance per borrower) (x '000)	-0.0167***	-0.0201***	-0.0200***	-0.0047**	-0.0264
	(0.0048)	(0.0063)	(0.0048)	(0.0019)	(0.0019)
Profit status dummy	0.0470***		0.0660**	0.0089	0.7974
	(0.0166)		(0.0273)	(0.0069)	(0.5153)
NGO dummy	0.0650***		0.0830***	0.0177**	0.6088
	(0.0171)		(0.0279)	(0.0071)	(0.3944)
Bank dummy	-0.1203***		-0.1494***	-0.0167	-0.2379**
	(0.0221)		(0.0346)	(0.0104)	(0.1203)
Personnel allocation ratio	0.5369***	0.1469***	0.3172***	0.0508**	0.2111
	(0.0457)	(0.0430)	(0.0369)	(0.0243)	(0.1628)
Percentage gross loan portfolio rural	0.0108	-0.0358*	-0.0175	0.0052	-0.0070
	(0.0199)	(0.0189)	(0.0168)	(0.0090)	(0.0271)
Operational self-sufficiency	-0.0344	0.0223	-0.0001	-0.0309*	0.0053
	(0.0240)	(0.0179)	(0.0170)	(0.0160)	(0.0649)
Ln borrowers per loan officer	0.1257***	0.0420***	0.0975***	0.0156**	0.0913**
	(0.0115)	(0.0146)	(0.0114)	(0.0063)	(0.0435)
Debt to equity ratio	0.0029**	-0.0006	0.0010	0.0008	-0.0000284
	(0.0013)	(0.0014)	(0.0012)	(0.0007)	(0.0042)
Ln assets	-0.0135***	0.0117	-0.0090*	0.0003	-0.0190
	(0.0041)	(0.0100)	(0.0054)	(0.0030)	(0.0141)
Gender inequality index	0.2909***	-0.0769	0.4332***	-0.0267	-0.2496
	(0.0883)	(0.2466)	(0.1176)	(0.0384)	(0.3905)
GDP per capita (percent growth)	0.0093***	0.0010	0.0029**	0.0018*	0.0036
	(0.0023)	(0.0014)	(0.0013)	(0.0010)	(0.0053)
GDP per capita current US (x '000000)	-9.6400***	-6.0200	-8.7700***	-2.3700**	-8.2400
	(2.2800)	(6.2000)	(3.1100)	(1.0000)	(9.7600)
Inflation consumer price (percent growth)	0.0109***	0.0002	0.0028**	0.0016*	-0.0024
	(0.0020)	(0.0013)	(0.0013)	(0.0009)	(0.0034)
Constant	-0.2642***	0.2431	-0.0938	-0.0146	-0.2496
	(0.0833)	(0.1893)	(0.1082)	(0.0403)	(0.3853)
Dummy variable year	Yes	Yes	Yes	Yes	Yes
Number of observations	966	966	966	734	734
R-squared (R^2)	0.6104	0.0830	0.5804	0.9309	
F-Test	74.01***	3.16***	509.00***	162.81***	220.42***
Sargan test					7.88

Note: Shown are pooled ordinary least square (POLS), fixed effects regression (FE-R), random effects generalized least squares (RE-GLS) linear panel regression, linear regression with panel-corrected standard errors (PCSE) and generalized method of moments estimator (GMM). Standard errors for the slope coefficients are in parentheses. m_2 is a test for second order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Sargan-Hansen test is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. ***p<0.01, **p<0.05, *p<0.1

Table 5.

Mediating role of female borrowers in the effect of female loan officers on loan portfolio risk.

First seemingly unrelated regressions (SUR) for panel data		
	Model 1 **Dependent variable:** **write off ratio**	**Model 2** **Dependent variable:** **PaR 30** *(Robustness test)*
Percentage female loan officers	0.2303***	0.2053***
	(0.0062)	(0.0113)
Percentage female borrowers	-0.7856***	-0.7577***
	(0.0077)	(0.0142)
Second seemingly unrelated regressions (SUR) for panel data		
	Model 1 **Dependent variable:** **percentage female borrowers**	**Model 2** **Dependent variable:** **percentage female borrowers** *(Robustness test)*
Percentage female loan officers	0.2512***	0.2289***
	(0.0048)	(0.0073)
Number of observations	976	976

Note: In the SUR regressions were included the same control variables used in the previous set of regressions. Standard errors for the slope coefficients are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6.

Instrumental variables (IV) estimation.

	Model 1 **Dependent variable:** **write off ratio** **IV with fixed effects**	**Model 2** **Dependent variable:** **percentage female borrowers** **IV with fixed effects**
Percentag female loan officers	0.3734*	0.4929*
	(0.2269)	(0.3071)
Number borrowers (percent growth)	-0.0125**	-0.0106
	(0.0063)	(0.0102)
Loan size (average loan balance per borrower) (x '000000)	-3.3800	-11.7000*
	(3.8400)	(6.0900)
Personnel allocation ratio	0.0451	0.1655***
	(0.0353)	(0.0506)
Percentage gross loan portfolio rural	0.0466***	0.0006154
	(0.0170)	(0.0260)
Operational self-sufficiency	-0.0475***	0.0211
	(0.0175)	(0.0234)
Ln borrowers per loan officer	0.0073	0.0421***
	(0.0103)	(0.0148)
Debt to equity ratio	0.0009	-0.0010
	(0.0013)	(0.0019)
Ln assets (x '000)	-0.0156	20.8000
	(0.0087)	(0.0136)
Gender inequality index	0.2473	-0.0518
	(0.1704)	(0.2619)
GDP per capita (percent growth)	0.0006	0.0011
	(0.0009)	(0.0014)
GDP per capita current US (x '000000)	2.3400	-6.7600
	(3.8100)	(6.2600)
Inflation consumer price (percent growth)	-0.0011	-0.0009
	(0.0010)	(0.0013)
Dummy variable year	Yes	Yes
Number of observations	789	746
R-squared (R^2)	-0.9042	-0.4445
F-test	1.87**	2.42**
Sargan test	0.164	0.274

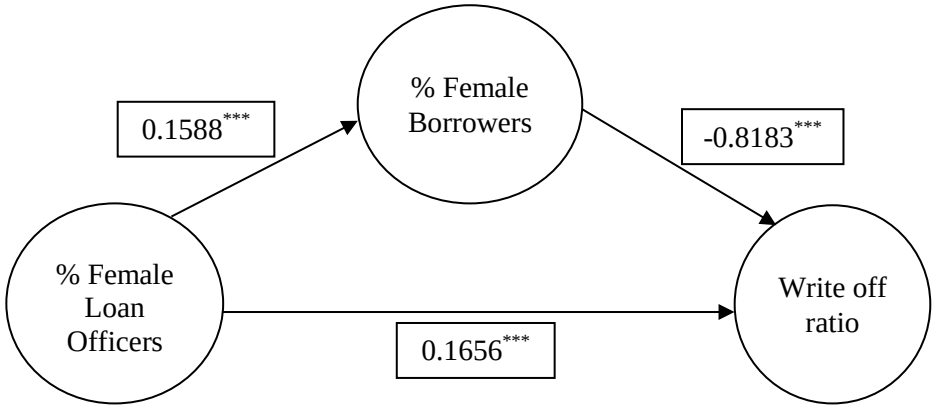
Standard errors for the slope coefficients are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

FIGURES

Figure 1.

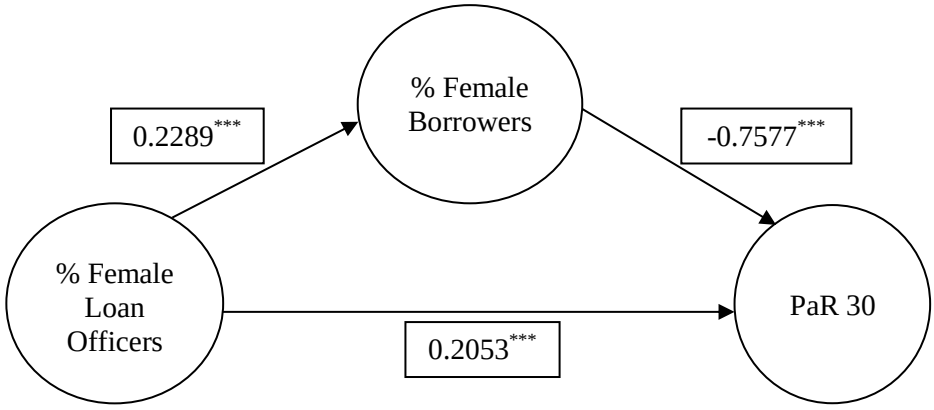
Mediating models by seemingly unrelated regressions.

Model A. Dependent variable: Write off ratio.



***p<0.01, **p<0.05, *p<0.1

Model B. Dependent variable: Portfolio at risk by more than 30 days (PaR 30) ***(Robustness test)***



***p<0.01, **p<0.05, *p<0.1

Appendix A.

Table A.1. Correlation matrix.

In this section we report the correlation matrix between the all variables used in the alternative models performed in this study. For variables with a squared-term in the model we applied a centering procedure which reduces inter-correlation (von Eye and Schuster, 1998). However, to further alleviate concerns of potential multicollinearity issues, we employed variance inflation factor (VIF) analysis. All resulting VIF values are well under 10, which is the threshold value for assessing multicollinearity (Hair et al., 2010; Kutner et al., 2005).

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) Write off ratio	0.219***	0.100**	-0.176***	-0.118***	0.042	-0.014	0.019	0.025	-0.092**	-0.093**	-0.171***	-0.162***	-0.066**	-0.048	0.068**	-0.125***	0.101**	-0.116***
(2) Portfolio at risk > 30 days		0.052*	-0.321***	-0.172***	0.211***	-0.061*	0.046	-0.057*	-0.230***	-0.082**	-0.144***	-0.112***	-0.062**	-0.077**	0.204***	-0.159***	0.156***	-0.152***
(3) Percentage female loan officers			0.121***	-0.039	0.010	-0.182***	0.154***	-0.032	0.014	-0.281***	-0.053*	-0.097**	-0.070**	-0.107***	0.130***	-0.080**	0.295***	-0.033
(4) Percentage female borrowers				0.010	-0.563***	-0.098**	0.252***	-0.273***	0.470***	0.190***	-0.054*	0.434***	0.114***	-0.238***	-0.202***	0.178***	-0.359***	0.386***
(5) Number active borrowers (percent growth)					0.012	0.115***	-0.115***	0.031	0.071**	-0.011	0.040	0.051	0.073**	0.063**	-0.039	0.095**	0.066**	0.036
(6) Loan size (average loan balance per borrower)						0.161***	-0.218***	0.297***	-0.393***	-0.247***	0.040	-0.406***	0.040	0.356***	0.254***	-0.063**	0.400***	-0.257***
(7) Profit status dummy							-0.752***	0.307***	-0.038	0.030	0.075**	-0.020	0.070**	0.315***	-0.052	0.194***	-0.047	0.131***
(8) NGO dummy								-0.256***	0.097**	-0.009	-0.113***	0.102**	-0.017	-0.300***	0.024	-0.158***	-0.058*	-0.036
(9) Bank dummy									-0.251***	-0.151***	0.033	-0.004	0.219***	0.461***	-0.125***	-0.003	-0.023	0.041
(10) Personnel allocation ratio										0.164***	0.050	-0.010	0.033	-0.135***	-0.297***	0.050	-0.193***	0.206***
(11) Percentage gross loan portfolio rural											0.101**	0.189***	0.098**	-0.081**	-0.160***	0.079**	-0.274***	0.141***
(12) Operational self-sufficiency												0.097**	-0.123***	0.234***	-0.071**	0.031	-0.008	-0.077**
(13) Ln borrowers per loan officer													0.091**	0.104***	-0.168***	0.141***	-0.191***	0.205***
(14) Debt to equity ratio														0.190***	-0.059*	0.176***	-0.187***	0.222***
(15) Ln assets															0.049	0.106***	0.046	-0.128***
(16) Global gender gap index																0.095**	0.295***	-0.256***
(17) GDP per capita (percent growth)																	-0.151***	0.204***
(18) GDP per capita current US																		-0.341***
(19) Inflation consumer price (percent growth)																		
VIF		1.37	2.50	1.06	2.14	2.65	2.74	1.58	1.70	1.27	1.19	1.96	1.23	1.76	2.62	1.16	2.10	1.44