Do Women Make the Difference?
The Effect of Gender on Microfinance Repayment Rates

By Cynthia M. Brenner

ABSTRACT

Cynthia Brenner is a graduate of the University of Notre Dame and the Georgetown Public Policy Institute. Gillette Hall, PhD served as her thesis advisor. Currently, Brenner is a Strategy and Operations Consultant with Deloitte Consulting's Federal Practice.

Since the financial crisis and the subsequent tightening of development assistance, foreign direct investment, and philanthropic donations, microfinance institutions (MFIs) have increasingly pushed financial independence as a means for ensuring their sustainability. Maximizing loan repayment rates is key to financial sustainability, reducing the cost of credit and dependence on subsidies. Many MFIs have adopted policies specifically targeting women in order to increase their impact on poverty reduction. The relationship between gender targeting and subsequent repayment rates has major implications for MFIs as they transition to financial independence. This study analyzes the effect of gender targeting on MFIs' financial sustainability by empirically examining the relationship between the proportion of female borrowers and repayment rates. Using the Microfinance Information Exchange's (MIX) global dataset covering 1,102 MFIs in 110 countries, the results indicate that female clients are associated with lower *portfolio-at-risks* and *write-off ratios* than their male counterparts. Furthermore, the results suggest there is a "tipping point" (30 percent female borrowers) above which women begin to repay at greater rates than men. Thus, this paper finds that the twin MFI goals of financial sustainability and targeting of loans to women are not contradictory; in fact, they are mutually reinforcing.

I. INTRODUCTION

As official development assistance[1] (ODA) continues to decrease, the sustainability of projects has become a key factor in all international development programs (OECD 2012). According to the International Finance Corporation (IFC 2011), sustainable development can be defined as "long-term business success contributing toward economic and social development, and to the overall stability of society." As donor budgets continue to tighten, achieving long-term program sustainability will require a shift from donor-funded subsidies to self-sufficient programs. Microfinance[2] has been touted throughout development circles as a powerful tool for navigating this transition. Meant to increase access to financial capital for the poor in the developing and developed world, microfinance refers to all financial products (loans, insurance, savings, and pensions) that are specifically geared toward poorer populations. Unlike many other antipoverty interventions, microfinance institutions (MFIs) can graduate from relying heavily on donor support to being completely financially independent. Yet, according to a recent United Nations (UN) study, only 10 percent of microlending organizations are self-sufficient as a majority of

institutions still rely on outside support (Skoll Foundation 2012). To shift toward full sustainability, MFIs need to carefully determine factors that will increase their repayment rates and ensure their liquidity and sustainability.

Gender targeting has been presented as a parallel solution, supported by an extensive literature highlighting the role of women as drivers of economic development. Pitt and Khandker (1998) find that giving women access to financial capital has a greater impact on poverty reduction than male borrowing, thus increasing their development impact. The consequence of this gender targeting on repayment rates is a key consideration for MFIs seeking financial independence, but available evidence is mixed and far from rigorous. Some country studies find that having more women borrowers increases the repayment rate, while others find that a greater amount of male borrowers can strengthen the repayment rate. There is a need for further robust research on the default rate implications of MFIs' gender-targeting policies.

Identifying the causal mechanisms that create higher repayment rates allows for increased financial sustainability across MFIs and subsequently, the achievement of industry-wide growth and self-sufficiency. Unlike most of the previous research that is drawn from single-country studies, this study uses a large cross-country database from the Microfinance Information Exchange (MIX) covering 1,103 MFIs

---

[1] Official development assistance (ODA) refers to bilateral aid given from one country to another country, or from one country to a multilateral aid institution.

[2] This paper discusses microcredit, or microloans, but it will use microfinance institutions as the unit of analysis.

across 110 countries over 15 years to empirically examine the link between the percent of women borrowers and an institution's repayment rate. A more rigorous cross-country analysis of this relationship will contribute to the literature on gender and microfinance and shed light on the differences in the credit risk between men and women.

II. LITERATURE REVIEW

The bulk of the literature on microfinance examines the economic impact of increased access to financial services.[3] Less research is focused on how to increase the financial sustainability of the MFI and yields less rigorous evidence. Every MFI tries to maximize its repayment performance, regardless of whether it is a for-profit institution or more focused on economic development. The benefits of high repayment rates are considerable as they affect the borrower, the institution, and the investor. Marie Godquin (2004) discusses the importance of focusing on repayment rates in MFI operations as it reduces the financial cost of credit, extending access to more borrowers. Lower default rates reduce dependence on subsidies, lower the borrower's interest rates, and improve sustainability. Additionally, Godquin argues that higher repayment rates reflect the efficiency and effectiveness of the MFI.

"… giving women access to financial capital has a greater impact on poverty reduction than male borrowing …"

Past research confirms that investing in women can increase their community and family status, which is beneficial for the community at large. Mayoux (2003) examines the link between access to finance and development through women's empowerment. She identifies two underlying assumptions of investing in women. First, evidence suggests that microfinance will automatically lead to women's empowerment and therefore faster macroeconomic growth. The second assumption is that women's empowerment, household level poverty alleviation, and community development are inherently connected. Increased well-being and group formation will automatically enable women to empower themselves. The Kiva Foundation concludes that financial services have improved the status of women within the family and the community: "Women have become more assertive and confident. In regions where women's mobility is strictly regulated, women have become more visible, are better able to negotiate in the public sphere… and play a stronger role in decision making."

While the strategy of targeting women in order to increase the development impact of microfinancing has been rigorously examined, studies on this policy's effect on the financial sustainability of the MFI are limited

_____
[3] These studies use GDP, HDI, and level of poverty as dependent variables, thus analyzing the growth of these programs against these measures of economic and social development.

and have returned mixed results. Kappel, Krauss, and Lontzek (2010) use the repayment rate of an institution to measure financial sustainability for microfinance institutions, as this indicator typically plummets prior to the crises at an MFI. Because microcredit lending procedures do not include a physical capital requirement, MFIs cannot continue their lending operations if repayment rates are low.

In an effort to solve this problem, several country studies look at the effects of gender targeting on repayment rate. Roslan and Karim (2009) analyze the Malaysian microfinance market using a logit-probability approach and find that the proportion of female borrowers exhibits a statistically significant negative effect on the repayment rate. These findings suggest the policy of targeting women detracts from the financial sustainability of an MFI.

In a similar study from Ghana, Richman and Fred (2004) find that increasing the share of male borrowers increases the repayment rate. Unlike Roslan and Karim, Richman and Fred use a fixed-effect approach to account for the differences across countries and time. Both studies use portfolio-at-risk 30 and 90 days to measure repayment rate and find that the share of female

"These results will contribute to a greater understanding of the relationship between gender targeting and repayment rates, testing the belief that women honor microcredit contracts better than men."

borrowers has a negative impact on the repayment rate.

These country-specific case studies contrast with a 2009 cross-country analysis by Merslund, D'Espallier, and Guerin, who find a positive effect of percent of women borrowers on bank liquidity through the repayment rate. Using 350 MFIs from 70 countries, the team uses fixed-effects and random-effects models to examine the policy of targeting women, using a portfolio-at-risk measure to operationalize repayment rate. The authors conclude that women are better credit risks, especially for non-profits and NGOs that run programs in conjunction with lending procedures. As the first cross-country analysis, Merslund, D'Espallier, and Guerin (2009) provide a framework for which to study these effects but acknowledge the need for further research due to their incomplete data.

Unexplored by Merslund, D'Espallier, and Guerin (2009) is whether the magnitude of the gender effect varies with the proportion of women borrowing from an institution. Godquin (2004) argues that the composition of group dynamics and social support systems directly affect the repayment rate. Social ties and group homogeneity can indirectly heighten repayment performance by facilitating peer monitoring and peer pressure (Besley and Coates 1995). Thus, theory suggests that the effect of women borrowers would vary depending on the number of women participating in microlending. As more women begin to take out loans, the

group dynamic would encourage better on-time repayment.

This paper aims to provide a more comprehensive study, including a sensitivity analysis of the relationship between gender and MFI repayment rates. This is important because of the unanalyzed belief that women honor their microcredit contracts more than men. Building on Merslund, D'Espallier, and Guerin (2009), this study uses a much larger dataset covering more institutions and more countries, accounting for regional variability in political economy and share of female borrowers in the hope of providing a more inclusive analysis. These results will contribute to a greater understanding of the relationship between gender targeting and repayment rates, testing the belief that women honor microcredit contracts better than men. A better understanding of these issues can help microfinance institutions strengthen repayment rates, creating positive benefits through lower interest rates and greater sustainability.

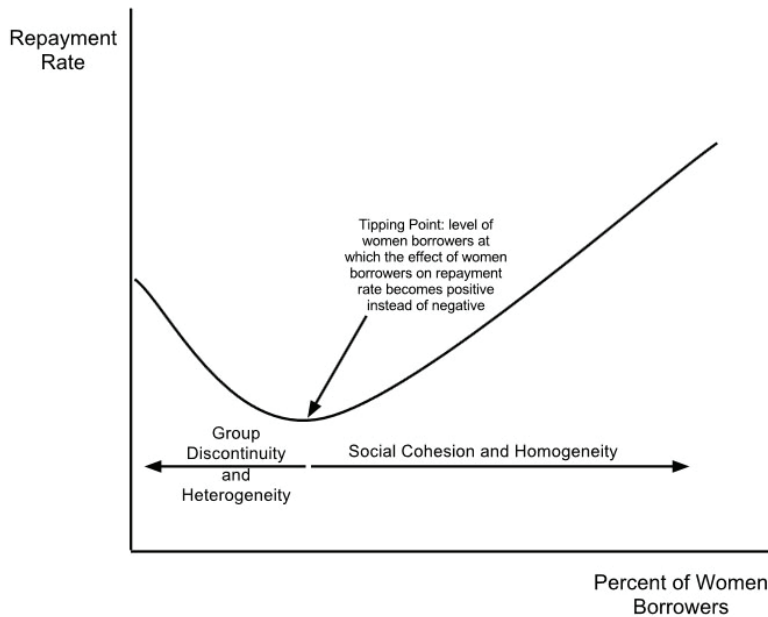## III. CONCEPTUAL FRAMEWORK & HYPOTHESIS

This paper asks what effect the number of women borrowers has on a bank's overall repayment rate, and whether the direction and magnitude of this effect varies depending on region and share of women borrowers. Microfinance advocacy networks and sponsors regularly assert that women are safer credit risks. The World Bank (2007) states that lending to women

leads to higher repayment rates due to the conservative nature of women's investments and the lower risk of moral hazard. In their assessment of the different techniques in reducing repayment defaults, Armendariz and Murdoch (2005) consider targeting women to be a technique in its own right alongside group lending or dynamic incentives. Competing results from individual country case studies suggest that this effect varies depending on region.

Providing credit to women has been highly popularized by the microfinance industry. As women make up more than 70 percent of the world's poor, the demand for loans is higher for women than for men. Merslund, D'Espallier, and Guerin (2009) argue that women invest their income in order to nurture the well being of their families; therefore, one dollar loaned to a woman has greater development impact and multiplier effect than one dollar loaned to a man. They also argue that this results in greater ease of repayment for women. Karim (2011) finds evidence that this effect varies by region because in areas where the incentive to repay is greater a "political economy of shame" can develop in joint-liability and self-help groups, thus increasing a woman's repayment in order to avoid being disgraced. This would indicate that a woman's repayment rate might vary by region due to cultural norms.

Group dynamics and group homogeneity have been linked to higher rates of repayment, as joint liability strengthens peer monitoring

Figure 1. Conceptual Framework for Possible "Tipping Point"

Repayment Rate

Tipping Point: level of women borrowers at which the effect of women borrowers on repayment rate becomes positive instead of negative

Group Discontinuity and Heterogeneity

Social Cohesion and Homogeneity

Percent of Women Borrowers

and peer pressure. This suggests a non-linear relationship between loan repayment rates and the percent of women borrowers. Initially, the ease of repayment will be weaker with few women participating in microlending, as there is a lack of social ties and peer monitoring. As the number of women borrowers grows, social cohesion and homogeneity should increase the repayment performance of participants (Zeller 1998). Specifically, this paper theorizes that at low levels of women borrowing, female repayment performance will be worse than male, but as the group dynamics grow more influential and more women become borrowers, there is a "tipping point" at which the effect of female borrowing becomes increasingly positive. The theory is illustrated in Figure 1.

This paper hypothesizes that the ratio of female borrowers should

ultimately have a negative effect on the portfolio-at-risk and write-off ratios in microfinance institutions. It further suggests that the direction and magnitude of this effect varies by region; in countries where the impetus and the cultural attitudes toward non-repayment are stronger, the effect of female borrowers on the repayment rate will be stronger. This effect is also allowed to vary according to the percentage of women borrowers in order to test the theory that as more women borrow, group dynamics contribute to increased repayment rates. Thus, this paper tests the following hypotheses through statistical analysis:

> H_1: An increase in the percent of women borrowers improves the repayment rate of a microfinance lending institution (MFI).

H_2: The effect of the percent of women borrowers on the MFI's repayment rate varies by region of the world.

H_3: The effect of women borrowers on an MFI's repayment rate varies over the range of the percentage of women borrowers in an MFI's portfolio.

IV. ECONOMETRIC MODEL

Repayment rate is operationalized through two different measures: portfolio-at-risk and write-offs. Through multiple estimation methods, this paper accounts for the methodological issues related to this type of assessment such as isolating the gender effect from other MFI or institutional effects that influence repayment, and accounting for the time-invariant nature of many covariates. Two different models are run in order to account for these methodological issues.

An ordinary least squares (OLS) model is run in order to assess the effect of female borrowers on the MFI's repayment rate while accounting for institutional and macroeconomic conditions as controls and contributors to the repayment rate. Both year and country controls are included in order to remove the bias on the coefficients and control for outside effects that may affect repayment rates. Developed by Plümper and Troeger (2007), a fixed-effects (FEVD) model is also run in order to account for time-invariant covariates and institutional fixed effects in the context of panel data. The OLS model is needed in order to let the region effects vary as these would drop out of a purely fixed model. Additionally, the OLS estimation allows

OLS Models

For Hypothesis 1:

$$PAR30 = \beta_0 + \beta_1 PercWomBor_i + \beta_2 MFIControls_i + \beta_3 CountryControls_i + \beta_4 YearControls_i + \mu_i$$

$$WriteOffRatio = \beta_0 + \beta_1 PercWomBor_i + \beta_2 MFIControls_i + \beta_3 CountryControls_i + \beta_4 YearControls_i + \mu_i$$

For Hypothesis 2:

$$PAR30 = \beta_0 + \beta_1 PercWomBor_i + \beta_2 PercWomenBor * Region_i + \beta_3 MFIControls_i + \beta_4 CountryControls + \beta_5 YearControls + \mu_i$$

$$WriteOffRatio = \beta_0 + \beta_1 PercWomBor_i + \beta_2 PercWomenBor * Region_i + \beta_3 MFIControls_i + \beta_4 CountryControls + \beta_5 YearControls + \mu_i$$

For Hypothesis 3:

$$PAR30 = \beta_0 + \beta_1 PercWomBor_i + \beta_2 PercWomenBor^2_i + \beta_3 MFIControls_i + \beta_4 CountryControls + \beta_5 YearControls + \mu_i$$

$$WriteOffRatio = \beta_0 + \beta_1 PercWomBor_i + \beta_2 PercWomenBor^2_i + \beta_3 MFIControls_i + \beta_4 CountryControls + \beta_5 YearControls + \mu_i$$

Fixed-Effects Models

For Hypothesis 1:

$$PAR30 = \beta_0 + \beta_1 PercWomBor_{it} + \beta_2 Z_{it} + \alpha_{it} + \mu_{it}$$

$$WriteOffRatio = \beta_0 + \beta_1 PercWomBor_{it} + \beta_2 Z_{it} + \alpha_{it} + \mu_{it}$$

For Hypothesis 3:

$$PAR30 = \beta_0 + \beta_1 PercWomBor_{it} + \beta_2 PercWomBor^2_{it} + \beta_3 Z_{it} + \alpha_{it} + \mu_{it}$$

$$WriteOffRatio = \beta_0 + \beta_1 PercWomBor_{it} + \beta_2 PercWomBor^2_{it} + \beta_3 Z_{it} + \alpha_{it} + \mu_{it}$$

Where Z is a vector of MFI time-variant controls.
Fixed effects (FEVD): Assume α_i is not independent of X_{it}, Z_i.

for an unbalanced panel, which boosts the sample size and strengthens the analysis.

The unit of analysis for all three estimation methods is the individual microfinance institution. In the OLS model, the analytical sample is limited to 2005 to 2009 due to missing data in earlier and more recent years.

V. DATA DESCRIPTION

This paper uses the Microfinance Information Exchange (MIX) Market data. It has been collected from more than 2,000 MFIs in 110 developing countries over 16 years and classified according to International Financial Reporting Standards (IFRS).[4] The financial, social, and operational information featured in MIX Market data is directly self-reported by individual institutions or affiliated network and/or gathered from the institutions' publications (i.e., annual report).

MIX analysts validate all data received and after doing a thorough accuracy check, MIX updates data and makes it publicly available. Data has been collected from 1995 to 2011, and there are 10,223 observations and 77 variables. This data is collected at the bank level, which creates an aggregation bias as it would be preferential to have individual data. Aggregation bias occurs if there is a loss of detail when the unit of analysis is aggregated around the institution instead of the individual. However, as this is a cross-country analysis, this data is a strong representation of what is occurring in the worldwide microcredit industry.

Portfolio-at-risk 30 and the *write-off ratio* are used to operationalize the repayment rate of the bank. *Portfolio-at-risk 30* is a variable that indicates the percent of loans that are overdue at least 30 days and takes a value ranging from 0 to 1. It is measured as portfolio-at-risk that is greater than 30 days late divided by the gross loan portfolio. The *write-off ratio* describes the percent of loans written off during the period, also measured as write-offs divided by

---

[4] This sample is limited for the analytical sample. Discussion of the creation of the analytical sample is later in the paper.

the gross loan portfolio. A write-off is an accounting procedure that removes the outstanding balance of the loan from the Loan Portfolio and from the Impairment Loss Allowance when the loan is recognized as uncollectible.

These variables are measured against the primary independent variable and control variables. The primary independent variable is the percent of women borrowers measured as the number of active women borrowers divided by the number of active borrowers. The average share of women borrowers is 64 percent but this varies by type of institution. Table 1 shows a breakdown of the percent of women borrowers by type of institution. As can be seen in Table 1, every type of institution has more than 50 percent women borrowers but Non-Banking Financial Institutions and Non-Governmental Institutions have much higher rates. These institutions also comprise the majority of the sample, which is similar to the composition of the microfinance industry as a whole (Rhyne 2010).

In addition, the analysis includes an interaction between the percent of

women borrowers and region of the world to determine whether this effect varies by country or region of the world.

As indicated by Merslund, D'Espallier, and Guerin (2009), numerous MFI control variables must be included in the analysis to properly isolate the effect of the primary variable of interest (percent female borrowers). Using past research, a number of key firm-level variables have been identified. These variables appear in the MIX data set as: *Target Market, Type of Institution, Regulated, Growth Rate of the Total Loan Portfolios, Staff Efficiency, Operational Self-Sufficiency, Cost per Borrower, Age of Institution, Average Loan Size, and Gross Loan Portfolio*. Additionally, the OLS models include a control for the country and year in which the MFI operates in order to account for varying macro-effects.

VI. RESULTS

Table 2 depicts the impact of gender on firms' *portfolio-at-risk* and the *write-offs* through an ordinary least squares (OLS) estimation method with robust standard errors to correct

Table 1. Breakdown of the Percent of Women Borrowers by Type of Institution
Descriptive Statistics of Type of Institution and Percent of Women Borrowers

Type of Institution	Bank	Credit-Union	Non-Banking Financial Institution	Non-Governmental Institution	Rural Bank	TOTAL
Percent of Women Borrowers	55.6%	52.3%	60.7%	75.9%	55.9%	64.3%
Number of Observations	312	679	1395	1578	286	4,260
Percent of Sample	7.3%	15.9%	32.7%	37.0%	6.7%	100.0%

Table 2. OLS Regression of Percent of Women Borrowers on Portfolio-at-Risk over 30 days and the Write-Off Ratio

Variables	(1) Portfolio-at-Risk	(2) Write-Off Ratio
Percent Women Borrowers	-0.0357***	-0.00568**
	(0.0074)	(0.00306)
MFI Age		
- mature age	0.0126***	0.0023*
	(.0037)	(0.0015)
- new age	-0.0228***	-0.0069***
	(0.0049)	(0.002)
Target Market		
- broad market	0.00567	-0.000505
	(0.0079)	(0.00317)
- highendmarket	-0.00673	-0.0044
	(0.00862)	(0.00347)
- lowendmarket	-0.00140	0.00238
	(0.00927)	(0.00372)
Type of Institution		
- Bank	0.0145**	0.00813**
	(0.00769)	(0.00314)
- NGO	0.00217	0.00299
	(0.00574)	(0.00238)
- NBFI	0.0015	0.00403
	(0.00553)	(0.00227)
RuralBank	0.039***	-0.00526
	(0.00884)	(0.00357)
Regulated	0.0115***	-0.00253
	(0.00419)	(0.00170)
Gross Loan Portfolio	-0.00457	-0.00210*
	(0.00286)	(0.00116)
Cost Per Loan	-2.83E-06	-1.78e-06
	(3.67e-06)	(1.49e-06)

Table 2 Continued

Variables	(1) Portfolio-at-Risk	(2) Write-Off Ratio
Operational Self-Sufficiency	-0.00569**	-0.00089
	(0.00252)	(0.00102)
log(Portfolio)	-0.0083***	0.000213
	(0.00168)	(0.000688)
log(Staff Efficiency)	-0.0102***	-0.00404***
	(0.00259)	(0.00106)
Provision for Impairment Loss	1.043***	0.492***
	(0.0437)	(0.0188)
Depositors per Staff Member	3.92e-05***	-1.25e-06
	(8.22e-06)	(3.42e-06)
Sustainability	-0.0233***	-0.00858***
	(0.0038)	(0.00154)
MFI Scale		
- large scale	-0.0019	-0.00457*
	(0.0067)	(0.0028)
- medium scale	-0.0058	-0.0019*
	(0.0044)	(0.0017)
Constant	0.246***	0.0681***
	-0.0199	-0.00817
Observations	4,326	4,260
R-squared	0.3211	0.329
Additional Controls		
Percent Women Borrowers missing values	Yes	Yes
Cost Per Loan missing values	Yes	Yes
Country Effects	Yes	Yes
Year Effects (2005-2009)	Yes	Yes

Standard errors in parentheses.

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

for potential heteroskedasticity. For gender, the proxy of *percent of women borrowers* is used to operationalize the influence of gender on the repayment rate. The different columns in Table 2 correspond to the different dependent variables. In both columns 1 and 2, the proportion of female borrowers is negatively related to the portfolio-at-risk and the write-off ratio. These estimated effects are highly statistically significant, though their effect is small. An increase of one percentage point of female borrowers is associated with a 0.036 percentage point decrease in the portfolio-at-risk, holding all else constant.

Looking at the other controls in Model 1, all of the significant coefficients take the predicted signs. *Rural bank, regulation, log(portfolio), staff efficiency, provision for loan loss impairment, depositors per staff member,* and *sustainability* are statistically significant. In particular, a lower portfolio-at-risk is associated with larger MFIs and larger portfolio growth rates, more highly regulated and sustainable MFIs, and MFIs with higher staff efficiency. Higher portfolio-at-risks are associated with MFIs that operate in rural areas, MFIs with a high depositor-to-staff ratio, and MFIs with a higher impairment loss-to-assets ratio.

For Model 2, the results are similar when the write-off ratio is the dependent variable. Higher write-off

	(1)	(2)	(3)	(4)
	Portfolio-at-Risk	Portfolio-at-Risk	Write-Off Ratio	Write-Off Ratio
Variables				
Percent Women Borrowers	-0.0363***	-0.0399***	-0.00568*	-0.00829**
	(0.00745)	(0.00848)	(0.00306)	(0.00410)
Cost Per Loan	-3.37E-06	-2.28E-06	-1.81E-06	-2.87E-06*
	(3.67E-06)	(3.36E-06)	(1.49E-06)	(1.62E-06)
Percent Women Borrowers Missing Variable Indicator	0.0220***		0.000218	
	(0.00511)		(0.00208)	
Cost Per Loan Missing Variable Indicator	-0.00571		-0.00127	
	(0.00381)		(0.00156)	
Constant	0.227***	0.214***	0.0577***	0.0815***
	(0.0215)	(0.0239)	(0.00875)	(0.0116)
Observations	4,330	2,771	4,264	2,751
R-squared	0.31	0.376	0.326	0.313

Table 3. Regression on Portfolio-at-Risk 30 days and Write-Off Ratio from 2005-2009

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.10

ratios are associated with larger banks and higher impairment loss-to-assets ratio. Lower write-off ratios are associated with higher staff efficiency, greater sustainability, and a larger gross loan portfolio.

The OLS model's missing variable indicators have been used for the primary independent variable of interest—*percent of women borrowers*—and an important control variable—*cost per loan.* As can be seen in Table 3, Models 1 and 3 correspond with Table 2's Models 1 and 2. Models 2 and 4 from Table 3 do not control for missing variables. The table shows that the missing variable indicators do not dramatically change the statistical significance of the coefficients or their magnitude. They do, however, significantly boost the number of observations while controlling for potential bias created by the missing values.

As argued in the literature review section, the effect of women borrowers should be more prevalent under certain conditions, such as the theory put forward by Karim (2011) that a region's culture creates a greater stigma on non-repayment by women. Based on the interaction effects observed between the percent of women borrowers and six regions of the world, this analysis does not support Karim's theory. For both dependent variables of interest, the interaction effects are neither individually nor jointly statistically significant, as can be seen in Table 4. This paper does not provide evidence that the effect of women borrowers on

the repayment rate varies by region, and therefore rejects Hypothesis 2.

The next models are analyzed in Table 5 through the fixed-effects estimation method. As can be seen in Table 5, most of the variables are statistically significant at conventional levels. This output not only tells us that the percent of women borrowers is associated with lower portfolios-at-risk and lower write-off ratios, but also suggests that more sustainable MFIs with larger portfolios and higher staff efficiency result in better repayment rates. On the other hand, higher costs per loan, higher impairment loss-to-assets ratio, and higher ratios of depositors-to-staff member ratios lower a bank's repayment rate.

In order to let the effect of women borrowers vary over the range of the percent of women borrowers, a quadratic term is added to the main regression in Table 6.[5] As can be seen, this functional form is significant at conventional levels, thus suggesting that the effect of women borrowers does vary over the range of percent of women borrowers in an MFI's portfolio. Specifically, when there is a smaller share of women borrowers compared to men (less than one-third female), the women borrowers increase the bank's *portfolio-at-risk* and *write-off-ratio*. At this level (33 percent of women borrowers for the write-off ratio and 35 percent of women borrowers for the portfolio at

_____

[5] Table 6 shows only the main effect and quadratic term as added into the main regression found in Table 2. No other results differ significantly.

Table 4. Interaction Effects between the Percent of Women Borrowers and Region Indicator Variables

Variables	(1) Portfolio-at-Risk	(2) Portfolio-at-Risk	(3) Write-Off Ratio	(4) Write-Off Ratio
Percent Women Borrowers	-0.0357***	-0.118	-0.00568**	-0.00100
	(0.0074)	(0.194)	(0.00306)	(0.0787)
MENA*percent women borrowers		0.121		-0.00663
		(0.195)		(0.0791)
Europe*percent women borrowers		0.0971		0.00650
		(0.195)		(0.0792)
SouthAmerica*percent women borrowers		-0.0474*		-3.34e-05
		(0.0271)		(0.0110)
LAC*percent women borrowers		0.0718		0.00361
		(0.195)		(0.0791)
Asia*percent women borrowers		0.103		-0.00175
		(0.195)		(0.0789)
SubSahAfrica*percent women borrowers		0.0474		-0.0233
		(0.195)		(0.0789)
Constant	0.227***	0.201***	0.0577***	0.0585***
	(0.0215)	(0.0236)	(0.00875)	(0.00962)
Observations	4,326	4,326	4,260	4,260
R-squared	0.3211	0.314	0.329	0.328
Additional Controls				
Percent Women Borrowers missing values	Yes	Yes	Yes	Yes
Cost Per Loan missing values	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Year Effects (2005-2009)	Yes	Yes	Yes	Yes

Standard errors in parentheses.

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

Table 5. Fixed-Effects Regressions on Portfolio-at-Risk and Write-Off Ratio

Variables	(1) Portfolio-at-Risk	(2) Write-Off Ratio
Percent Women Borrowers	-0.0346**	-0.0181**
	(0.0139)	(0.00861)
MFI Age		
- mature age	0.0044	0.0021
	(0.0052)	(0.0032)
- new age	-0.0056	-0.0113**
	(0.0073)	(0.0045)
Sustainability	-0.0135***	-0.00984***
	(0.00448)	(0.00277)
Cost Per Loan	2.97E-06**	1.65e-06*
	(1.46e-06)	(8.84e-07)
Gross Loan Portfolio	-5.81E-04**	-2.79E-04*
	(2.70e-05)	(1.63e-05)
Log(Staff Efficiency)	-0.0158***	-0.0325***
	-0.00478	-0.00304
Provision for Loan Loss Impairment	0.915***	0.213***
	(0.0447)	(0.0313)
Depositors per Staff Member	6.38E-04***	2.08E-04***
	(1.01e-05)	(6.24e-06)
Constant	0.158***	0.172***
	(0.0303)	(0.0194)
Observations	3,219	3,218
Number of MFI Names	1,102	1,103
R-squared	0.2323	0.113
Year Fixed Effects	Yes	Yes
MFI Fixed Effects	Yes	Yes

Standard errors in parentheses.

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

Table 6. Regression of Percent of Women Borrowers Quadratic on the Repayment Rate

Variables	(1) Portfolio-at-Risk	(2) Portfolio-at-Risk	(3) Write-Off Ratio	(4) Write-Off Ratio
Percent Women Borrowers	-0.0357***	0.0552**	-0.00568**	.0085*
	(0.0074)	(0.0281)	(0.00306)	(0.00115)
Percent Women Borrowers Squared		-0.0781***		-0.0122**
		(0.0231)		(0.00095)
Constant	0.227***	0.226***	0.0577***	0.0651***
	(0.0215)	(0.021)	(0.00875)	(0.0085)
Observations	4,326	4,326	4,260	4,260
R-squared	0.3211	0.323	0.329	0.329
Additional Controls	Yes	Yes	Yes	Yes
Percent Women Borrowers missing values	Yes	Yes	Yes	Yes
Cost Per Loanmissing values	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Year Effects (2005-2009)	Yes	Yes	Yes	Yes

Standard errors in parentheses.

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

risk), there is a "tipping point" where the effect of more women borrowers increases or strengthens the banks overall repayment rate. This effect is consistent with the theory stated prior that with higher proportions of women borrowers, groups and support systems strengthen the ability of women to repay the loan as compared to men.

The results from Table 2 and Table 5 indicate a negative association between the number of female clients and repayment, confirming Hypothesis 1 that the proportion of female clients reduces the MFI's default rate. Hypothesis 3 is also confirmed by the results noted in Table 6, suggesting that the gender effect on repayment performance varies by the percent of women borrowers at an individual MFI. These effects hold for multiple measures of repayment (*par30* and *write-offs*) and for several estimation methods (OLS and FEVD*).

VII. GENDER & LOAN SIZE

One can conclude from this study that women are repaying their microfinance loans at a greater rate than men are. Yet the reason behind these lower portfolios-at-risk and write-off ratios has not been determined. Examining the descriptive statistics of average loan sizes and the different quartiles of the share of women borrowers suggests that one reason for the higher repayment is the smaller loans being given at institutions that target women.

Table 7. Banks with Smaller Share of Women Borrowers Have Larger Average Loan Size
Descriptive Statistics of Average Loan Size and Percent of Women Borrowers

Quartile of Percent of Women Borrowers	First Quartile: 0% to 43%	Second Quartile: 43% to 65%	Third Quartile: 65% to 91%	Fourth Quartile: 91% to 100%	Total
Average Loan Size	$2,289.79	$1,810.88	$784.80	$194.37	$1,352.33
Number of MFIs	276	275	276	275	1,102
Percent of Sample	25%	25%	25%	25%	100%

Is higher repayment being driven by women, or are women choosing smaller loans and therefore greater ease of repayment? If women frequent institutions with smaller loans as a means to ensure on-time repayment or because of MFI preference, the endogeneity[6] would cause a bias in the coefficient on percent of women borrowers in the previous models. In order to correct for the endogeneity that may exist, an instrumental variable regression is used to parse out the gender effect from loan size on the repayment rate (Table 8). A variable was created that captures the deviation from the average loan size in order to measure the difference between what women are receiving as a loan and what size loan is being given to the average client.

Estimating through two stage least square[7] (2sls), a variable is an effective instrument if it passes both the relevance restriction and the exogenous restriction.[8] According to Stock and Watson (2011), an instrument is relevant when the variation in the instrument is related to variation in the independent variable of interest. This analysis finds both variables relevant based on their respective F-statistics in Table 8.[9]

_____

[6] Endogenous variables are determined within the model, as compared to an exogenous variable determined outside the model. With an endogenous variable, causality would run both from the percent of women borrowers to the repayment rate and from the repayment rate to the percent of women borrowers.

[7] Stock and Watson (2011) describe this estimation method: "As the name suggests, the two stage least squares estimator is calculated in two stages. The first stage decomposes X into two components: a problematic component that may be correlated with the regression error and another problem-free component that is uncorrelated with the error. The second stage uses the problem-free component to estimate the coefficient."

[8] Computing the t-stat in the first stage can test the relevance condition. The validity/exogeneity condition, however, cannot be tested, because the condition involved the unobservable residual μ. Therefore this condition has to be taken on faith.

[9] This can be tested in the first stage of the process by looking at the F-stat for the overall regression being greater than 10. As seen in Table 8, the F-stat for the first stage is 312.85 for the *portfolio-at-risk* dependent variable and 296.03 for the *write-off ratio*.

Table 8. Regression Using Deviation from Mean Loan Size as an Instrumental Variable

	(1)		(2)		(3)		(4)
Instrument	First Stage: PAR30	Instrumented	Second Stage: PAR30	Instrument	First Stage: WriteOff Ratio	Instrumented	Second Stage: WriteOff Ratio
Deviation from Mean Loan Size	-0.0000159*** (8.96E-07)			Deviation from Mean Loan Size	-0.0000156*** (9.08E-07)		
Constant	0.6328*** (0.0030)	Constant	0.0352*** (0.0662)	Constant	0.6347*** (0.00321)	Constant	0.00166*** (0.0237)
		Percent Women Borrowers	0.04855 (0.1026)			Percent Women Borrowers	0.0254 (0.0368)
Observations	5,225		5,225		4,691		4,691
F-Statistic	312.85		.		296.03		.
R-squared	0.0563				0.0594		.

Standard errors in parentheses.

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

The instrument satisfies the exogenous condition if it captures movements in the independent variable of interest that are also exogenous while only affecting the dependent variable through the variable being instrumented. This condition cannot be empirically tested with only one instrument and one variable. Deviation from the average loan size could be argued as being exogenous in that higher- or lower-than-average loan amounts are driven partly by the women's preferences. This is exemplified by the greater number of women borrowing from institutions with lower average loan sizes or by women choosing to not take on as much debt as men. This variable is also a function of the borrower's demand for MFIs with certain average loan sizes and the supply of MFIs in an area. As this demand and supply cannot be easily measured, it biases the *percent of women borrowers* variable in the OLS and FEVD regressions. Furthermore, deviation from the average loan size does not directly affect the dependent variables representing repayment, as both dependent variables are functions of the total loan portfolio size, and thus the average loan of the bank is taken into account into their calculation. Therefore, the deviation variable captures the difference between the average loan sizes of the MFI compared to the worldwide average loan size. This should not directly affect an institution's repayment rate except through the gender of the borrower that chooses to frequent an MFI with either a lower or higher average loan size.

Table 8 depicts whether it is this choice, measured by the deviation from the mean loan size, which is driving the higher repayment rates. If the unit of analysis were the individual borrower

or individual loan, this would not be an appropriate instrument as it would be biased by past repayment history and individual characteristics.

The results of the second stage, shown in columns 2 and 4, demonstrate that the percentage of women borrowers is no longer a significant predictor of repayment rates. This suggests that the positive effect of women borrowers found earlier can be partly explained by the loan size chosen by women compared to men. Thus, women are repaying at higher rates, but their ability to do so is driven partly by their preference of loan size or banking institution. This is a first step in the process of determining the characteristics of women that cause higher on-time repayment rates than men.

VIII. POLICY IMPLICATIONS & CONCLUSION

This paper uses MIX's global dataset covering 1,102 MFIs in 110 countries to test whether there is a gender effect on microfinance repayment. The findings indicate that MFIs with higher proportions of female borrowers have a lower *portfolio-at-risk* and *write-off ratio*. These results provide compelling, rigorous evidence that focusing on female clients enhances microfinance repayment rates and that women are generally a better credit risk.

By increasing repayment rates, an MFI not only benefits from lower risk and greater revenue, it also becomes a more sustainable institution and less dependent on donor contributions.

"These results provide compelling, rigorous evidence that focusing on female clients enhances microfinance repayment rates and that women are generally a better credit risk."

Borrowers also benefit from higher MFI repayment rates as interest rates decrease with lower default rates and investors will receive higher returns that make the investment more appealing. This is important because repayment has become increasingly important to the sustainability of microfinance as a development tool. Repayment is studied through two different measures: portfolio-at-risk and the write-off ratio, and gender is studied through the proportion of female clients.

Breaking down the results further, the findings indicate that at much lower levels of women borrowers, women are unable to pay their loans at higher rates than men. There is a "tipping point" at 33 percent and 35 percent where both the portfolio-at-risk and write-off ratio begin to benefit from women borrowers. The finding is supported by research from Zeller (1998) and Godquin (2004), who suggest that group dynamics and social homogeneity directly impact the repayment rate through peer monitoring, incentives, and peer pressure. These findings suggest that MFIs should move toward preferential treatment of women borrowers, thereby creating the group dynamic that benefits both borrowers and institutions.

> "... MFIs' twin goals of financial sustainability and gender targeting are not contradictory; in fact, they are mutually reinforcing."

The results do not find evidence supporting the theory put forth by Karim (2011) that cultural norms inflict greater shame on women, thus increasing their repayment rates. The interaction terms reveal that there is no statistically significant variation of women's repayment by region. By extension, the findings do not support Karim's thesis that cultures with a higher impetus of shame will provide greater embarrassment for non-repayment and dishonor women who fall into debt.

In exploring the driving force behind women's higher repayment, this paper examines gender disparities in loan sizes. The analysis finds the difference in repayment rate between men and women to be negligible when controlling for women's preference for smaller loans or different types of institutions. Since women are given smaller loans on average, they are more likely to be able to repay them at on-time rates. Due to data limitations, this paper could not determine the reason for the smaller loans or whether the group dynamic would be able to compel greater repayment when women do take large loans. Further research is needed in this area to understand the effect of gender on the repayment rate at higher loan levels. In particular, studies should focus on

high-value loans to determine whether women have lower default rates.

This paper shows that the difference in the loan size demanded by women compared to the worldwide average loan size could be one explanation for higher rates of on-time repayment. Potentially women are not receiving opportunities for larger loan sums. Or are banks that target women setting more lenient and favorable repayment schedules? Further research is needed on the driving force in order to understand the factors leading to higher repayment rates.

Overall, this paper finds compelling cross-country evidence of what policy makers and practitioners have long argued: women are better at repaying microfinance loans than men are. It is interesting to observe that despite a lower objective credit-worthiness due to greater lack of assets, women prove to be better borrowers and better credit risks. Therefore, MFIs' twin goals of financial sustainability and gender targeting are not contradictory; in fact, they are mutually reinforcing.

IX. REFERENCES

Godquin, Marie. 2004. Microfinance repayment performance in Bangladesh: How to improve the allocation of loans by MFIs. W*orld Development* 32: 1909-1926.

International Finance Corporation. 2011. Developing value: The business case for sustainability in emerging markets. Washington, DC: International Finance Corporation.

Kappel, Vivien, Annette Krauss, and Laura Lontzek. 2010. Over-indebtedness and microfinance–constructing an early warning index. Working Paper, Center for

Microfinance/University of Zurich.

Kiva Foundation. 2012. Microfinance can be a good tool for empowering women. *Kiva.org*, http://www.kiva.org/about/microfinance.

Mayoux, Linda. 2009. Gender and rural microfinance: Reaching and empowering women. Guide for Practicioners. Rome: International Fund for Agriculture Development, http://www.ifad.org/gender/pub/gender_finance.pdf.

Merslund, Roy, Bert D'Espallier and Isabelle Guerin. 2009. Women and Repayment in Microfinance, Working Paper RUME 2009-02, Provence University/Rume Project, Marseille, France.

OECD. 2012. Development: Aid to developing countries falls because of global recession. Working Paper, Organization for Economic Co-operation and Development, http://www.oecd.org/document/3/0,3746, en_21571361_44315115_50058883_1_1_1_1,00.html en_21571361_44315115_50058883_1_1_1_1,00.html.

Rhyne, Elizabeth. 2010. The state of global microfinance: How public and private funds can effectively promote financial inclusion. Hearing before the House Subcommittee on International Monetary Policy and Trade, 111th Congress, http://www.cmef.com/Document.Doc?id=773.

Roslan, A.H. and Mohd Zaini Abd Karim. 2009. Determinants of microcredit repayment in Malaysia: The case of Agrobank. H*umanity and Social Sciences Journal* 4: 45-52.

Skoll Foundation. 2012. Micro-lending. Social Edge, a program of the Skoll Foundation, http://www.socialedge.org/blogs/beyond-good-intentions/archive/2009/05/25/micro-lending.

Stock, J.H., and Watson, M.W. 2011. *Introduction to Econometrics*. Boston: Pearson Education.

Zeller, M. 1998. Determinant of repayment performance in credit groups: The role of program design, intragroup risk pooling, and social cohesion. *Economic Development and Cultural Change* 46: 599–621.