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**Paper #4 - Microcredit African Country Production**

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University of Texas at Dallas

Glen Cooper

for

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## Hypotheses

This paper's research question is: Why do some African countries have more microloan financing than other African countries? To investigate this question three hypothesis are put forward to explain higher/lower levels of microloan financing within a given country: 1) Greater female participation in supplying microloan financing; 2) Greater quality of lending laws; and 3) Lesser *intracountry* violence.

## Methodological Approach

Sample data was obtained from those African countries that are reporting microfinancing through the Mix Market (The Mix, n.d.) online database. The Mix is an individual company self-reporting database used by microfinancing companies to track lending practices throughout the world. All data is annual and to the extent country data is available, covered the years from 2000 to 2017. The countries shown in the table below were incorporated:

Angola	Cote d'Ivoire	Malawi	South Sudan
Benin	Ethiopia	Mali	Sudan
Burkina Faso	Gabon	Mozambique	Swaziland
Burundi	Gambia, The	Namibia	Tanzania
Cameroon	Ghana	Niger	Togo
Central African Republic	Guinea	Nigeria	Uganda
Chad	Guinea-Bissau	Rwanda	Zambia
Comoros	Kenya	Senegal	Zimbabwe
Congo, Democratic	Liberia	Sierra Leone	
Congo, Republic	Madagascar	South Africa	

In order to test the hypotheses, the following model was developed:

$$\text{Microlending}_{it} = \alpha + \beta_1 * \text{FemaleParticipation}_{it} + \beta_2 * \text{Intracountryviolence}_{it} + \beta_3 * \text{QualityLendingLaws}_{it} + \beta_4 * \text{CV}_{ijt} + \epsilon_{it}$$

With:

i = Country

t = Year

CV = control variables

j = specific CV model specification

$\epsilon$  = Error term

The smallest number of observations in the dataset was 154. Therefore, in order to avoid constraints relating to degrees of freedom, the CVs were included as individually separate models. The follow control variables (CVs), available from the World Bank (World Bank Open Data, n.d.), were included:

Control Variables
Lending Interest Rate
GDP per Capita Purchasing Power Parity (PPP)
Population
CPI
Unemployment Rate
Percent Headcount below Poverty
Percent Poverty Gap

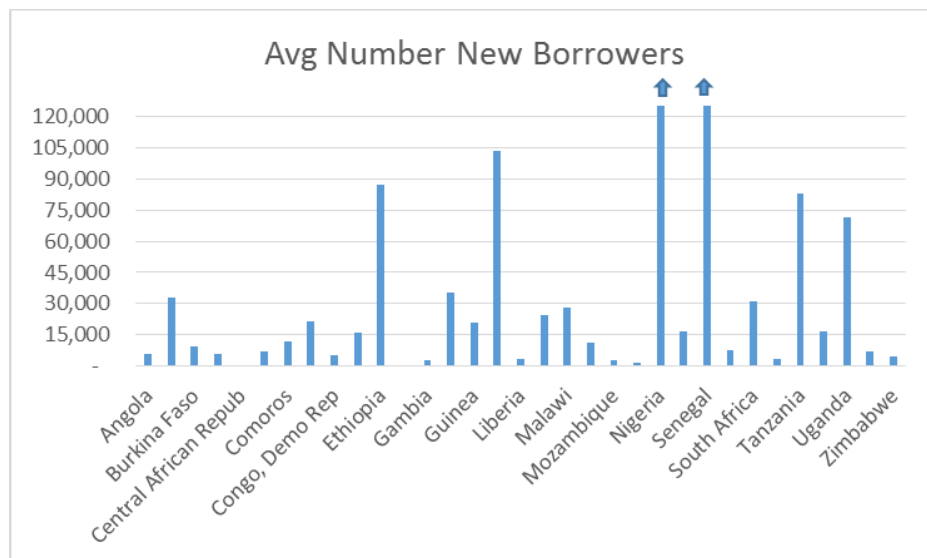
The dependent variable (DV) was operationalized as follows:

Dependent Variable	Operationalized As
Microfiance lending	Number of New Borrower Loans (The Mix, n.d.)

The independent variables (IVs) were operationalized as follows:

Independent Variable	Operationalized As
Female participation in supplying microloan financing	Percentage of Female Loan Officers (The Mix, n.d.)
Intracountry violence	State and Nonstate Intracountry Violence Total (Uppsala Conflict Data Program, n.d.)
Quality of country lending laws	Strength of Country Legal Rights (World Bank - Strength of legal rights index, n.d.)

The following graph provides a visualization of the operationalized DV:



As displayed there is substantial variation in the DV. Many countries produce a relatively small level of loans while others fund a substantial number (note, the two off-the-scale upward arrows represent Nigeria and Senegal which produced an average annual new borrower loan count of 1 million and 850 thousand, respectively).

The IVs are represented below.



Visually, there is substantial variation in the average percent of female loan officers, and lesser variation in the violence and strength of legal rights IVs.

Concerns over data distribution normality motivated, a Kernel density estimation or Parzen–Rosenblatt window method (Parzen, 1962 and Rosenblatt, 1956) analysis. The results of this analysis suggested that, except for the legal rights IV and the two poverty CVs, a logarithmic transformation of the DV and the other IVs and CVs variables would

improve the normalization of the level data. Therefore, the appropriate transformations were made.

In order to evaluate multicollinearity, a correlation matrix was prepared. Only two variables had a correlation of more than 80%, namely, Unemployment Rate and GDP per Capita PPP. However, these variables will not be included in the same model and, therefore, there is no risk of collinearity occurring between them. A few other variables had less significant correlations. Below is the correlation matrix:

Variable	Percent Female Loan Officers	Intrastate Violence	Strenght Legal Rights	GDP per Capita PPP	Lending Rate	Unemployment Rate	Population	CPI	Poverty Headcount Ratio	Poverty Gap Percentage
Percent Female Loan Officers	1.00									
Intrastate Violence	-0.23	1.00								
Strenght Legal Rights	-0.08	0.20	1.00							
GDP per Capita PPP	0.18	0.08	-0.05	1.00						
Lending Rate	-0.03	-0.05	-0.57	-0.12	1.00					
Unemployment Rate	0.23	-0.07	0.12	0.83	-0.14	1.00				
Population	-0.07	0.61	0.19	0.43	0.09	0.20	1.00			
CPI	0.14	0.15	-0.22	0.18	0.27	-0.05	0.34	1.00		
Poverty Headcount Ratio	0.17	0.03	-0.03	0.12	-0.30	0.17	-0.03	-0.13	1.00	
Poverty Gap Percentage	0.06	-0.04	-0.37	0.25	0.35	0.33	-0.07	-0.09	0.43	1.00

Given the nature of the dataset a panel data regression methodology was utilized. In developing a panel data model there is a choice between using fixed effects or random effects techniques. Although it seems reasonable that each country would have some unique characteristic which would suggest the use of a fixed effect model, this intuition was tested using the Hausman test. The Hausman test establishes the null hypothesis that the random effects model is preferred and the alternative hypothesis being a fixed effects model (Greene, 2008). The results of the Hausman test had conflicting results depending upon which CVs were included. Therefore, as the fixed effects model was more theoretically suggestive, it was utilized.

The final results for each model is presented in the table below:

Panel Data Fixed Effects Model / Coefficient & Standard Errors			
Independent Variables			Control Variables
Percent Female LOs	Violence	Legal Rights Index	<b>Lending Rate</b>
<b>0.803**</b> (0.399)	<b>-0.351*</b> (0.206)	0.720 (0.556)	<b>7.433***</b> (2.356)
<b>0.906**</b> (0.394)	-0.031 (0.203)	0.275 (0.416)	<b>GDP per Capita PPP</b> <b>-9.110***</b> (2.949)
<b>0.855**</b> (0.417)	-0.120 (0.204)	0.558 (0.471)	<b>CPI</b> <b>-3.880**</b> (1.730)
<b>0.844**</b> (0.386)	0.033 (0.203)	0.525 (0.420)	<b>Population</b> <b>-15.942***</b> (5.128)
<b>0.935**</b> (0.414)	-0.212 (0.202)	0.097 (0.408)	<b>Unemployment Rate</b> -0.137 (0.592)
<b>0.760*</b> (0.412)	-0.221 (0.206)	0.468 (0.477)	<b>Poverty HC Ratio</b> -0.045 (0.030)
<b>0.782*</b> (0.404)	-0.163 (0.204)	-0.038 (0.443)	<b>Poverty Gap</b> 0.282 (0.177)

\*\*\* P<.01; \*\* P<.05; \* P<.10

Regarding the IVs, the most obvious observation is that for all models the Percent Female Loan Officers coefficient is positive and significant. Therefore, a greater percentage of female loan officers results in more new borrowers. This was expected, as previous literature has suggested, female involvement in microfinancing lending improves microfinance institution performance (Boehe & Cruz 2013), (Hartarska, et al.

2014), (Mori, et al. 2015), (Strøm, et al. 2014). All but one of the models has the violence coefficient as negative. A negative coefficient was expected because increased intrastate violence would likely lead to greater lending risk and, therefore, fewer loans. However, only one of the specifications shows any significances and that significance is at the lower probability level. For all the models the Legal Rights Index coefficient is positive. This again should be expected because the stronger the legal protections afforded business activity the more likely lending will occur. However, under no specification is the variable significant. Therefore, the only statistically valid conclusion is that the higher the percentage of female loan officers the more likely it is that there will be larger numbers of microfinance loans.

The analysis of the CVs is challenging. Of the four CVs showing significance, namely, Lending Rate, GDP per Capita PPP, CPI, and Population; only the GDP per Capita PPP has a coefficient that is directional intuitive. The coefficient for the GDP per Capita PPP is negative. This is an anticipated direction because, as the GDP per person increases, there would be less demand for microfinancing which targets the poor. The negative value of the CPI coefficient might relate to the reluctance lenders have to lending during the uncertainty created in raising price environments. However, that relationship is probably more complicated and may not hold. There is little justification for why higher lending rates would increase microfinance or why increasing population would cause a fall in microfinancing. More research is needed in these areas.



### Robustness Test

The observation that Female Participation IV was significant under all seven CVs indicates an important level of robustness in the results. However, to further examine the robustness of the Female Participation IV, two alternative operationalized IVs were evaluated: 1) Percent of Female Managers, and 2) Percent of Female Board of Directors. The models were developed under the same methodology detailed above. Both IVs were log transformed and evaluated as before using Kernel density estimations (Parzen, 1962 and Rosenblatt, 1956). The results of this analysis suggested that log transformation was appropriate. As before the fixed effects regression model was utilized. Below are the results from the female manager IV:

Panel Data Fixed Effects Model / Coefficient & Standard Errors			
Independent Variables			Control Variables
Percent Female Managers	Violence	Legal Rights Index	<b>Lending Rate</b>
0.548	-0.009	0.605	<b>6.745***</b>
(0.815)	(0.205)	(0.522)	(2.248)
			<b>GDP per Capita PPP</b>
1.220	0.082	0.290	<b>-8.019***</b>
(0.752)	(0.191)	(0.373)	(2.693)
			<b>CPI</b>
0.936	-0.027	0.214	-0.890
(0.795)	(0.198)	(0.444)	(1.749)
			<b>Population</b>
<b>1.550**</b>	0.049	0.384	<b>-8.220*</b>
(0.750)	(0.186)	(0.373)	(4.694)
			<b>Unemployment Rate</b>
<b>1.368*</b>	-0.121	0.145	<b>-0.375</b>
(0.770)	(0.192)	(0.358)	(0.553)
			<b>Poverty HC Ratio</b>
0.858	-0.062	0.438	-0.039
(0.831)	(0.195)	(0.418)	(0.026)
			<b>Poverty Gap</b>
1.002	-0.031	0.049	0.035
(0.790)	(0.191)	(0.386)	(0.162)

\*\*\* P<.01; \*\* P<.05; \* P<.10

And below are the results from the Board of Director IV:

Panel Data Fixed Effects Model / Coefficient & Standard Errors			
Independent Variables			Control Variables
Percent Female Board Members	Violence	Legal Rights Index	<b>Lending Rate</b>
0.548	-0.009	0.605	<b>6.745***</b>
(0.815)	(0.205)	(0.522)	(2.248)
			<b>GDP per Capita PPP</b>
1.220	0.082	0.290	<b>-8.019***</b>
(0.752)	(0.191)	(0.373)	(2.693)
			<b>CPI</b>
0.936	-0.027	0.214	-0.890
(0.795)	(0.198)	(0.444)	(1.749)
			<b>Population</b>
<b>1.550**</b>	0.049	0.384	<b>-8.220*</b>
(0.750)	(0.186)	(0.373)	(4.694)
			<b>Unemployment Rate</b>
<b>1.368*</b>	-0.121	0.145	<b>-0.375</b>
(0.770)	(0.192)	(0.358)	(0.553)
			<b>Poverty HC Ratio</b>
0.858	-0.062	0.438	-0.039
(0.831)	(0.195)	(0.418)	(0.026)
			<b>Poverty Gap</b>
1.002	-0.031	0.049	0.035
(0.790)	(0.191)	(0.386)	(0.162)

\*\*\* P<.01; \*\* P<.05; \* P<.10

While in both of these two models only twice does the Female Participation alternative operationalization IV, appear significant (i.e. under the population and unemployment rate CVs) this is not unexpected because both managers and board members generally are further away from the actual loan transaction when compared to the loan officer's direct customer contact. Therefore, finding at least a few specifications showing Female Participation as significant under these alternative operationalized IVs does suggest that there is some robustness to the original results.

Note the other IVs – Intracountry violence and Quality of Lending Laws – having shown little or no significance were not separately tested for robustness.

### Conclusion

In conclusion, the results appear compelling. There is considerable support at .05 level for the conclusion that female participation in the microfinance loan transaction is associated with a greater number of loans being produced. However, there is little to no support for the conclusion that intrastate violence or quality of lending laws results in a change in microfinance loan production.

## References:

- Boehe, D. M., & Cruz, L. B. (2013). Gender and Microfinance Performance: Why Does the Institutional Context Matter? *World Development*, 47, 121-135. doi:10.1016/j.worlddev.2013.02.012
- Greene, William H. (2008). *Econometric analysis*, 6th ed., Upper Saddle River, N.J. : Prentice Hall, Chap 9.
- Hartarska, V., Nadolnyak, D., & Mersland, R. (2014). Are Women Better Bankers to the Poor? Evidence from Rural Microfinance Institutions. *American Journal of Agricultural Economics*, 96(5), 1291-1306. doi:10.1093/ajae/aau061
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the econometric society*, 1251-1271.
- Mori, N., Golesorkhi, S., Randøy, T., & Hermes, N. (2015). Board Composition and Outreach Performance of Microfinance Institutions: Evidence from East Africa. *Strategic Change*, 24(1), 99-113. doi:10.1002/jsc.2000
- Parzen, E. (1962). On estimation of a probability density function and mode. *The annals of mathematical statistics*, 33(3), 1065-1076.. On estimation of a probability density function and mode. *The annals of mathematical statistics*, 33(3), 1065-1076.
- Rosenblatt, M. (1956). Remarks on some nonparametric estimates of a density function. *The Annals of Mathematical Statistics*, 832-837.
- Strøm, R. Ø, D'Espallier, B., & Mersland, R. (2014). Female leadership, performance, and governance in microfinance institutions. *Journal of Banking & Finance*, 42, 60-75. doi:10.1016/j.jbankfin.2014.01.014
- The MIX: (n.d.). <https://www.themix.org/mixmarket/>
- Uppsala Conflict Data Program. (n.d.). Retrieved March 20, 2019, from <https://ucdp.uu.se/>
- World Bank (n.d.) Strength of legal rights index (0=weak to 12=strong). Retrieved March 20, 2019, from <https://data.worldbank.org/indicator/IC.LGL.CRED.XQ?view=chart>
- World Bank Open Data. (n.d.). Retrieved from <https://data.worldbank.org/>