Econometric Analysis of Profitability of Microfinance Institutions in Selected Asian Countries

Janda, Karel and Turbat, Batbayar

University of Economics, Prague, Charles University in Prague

13 November 2013

Econometric Analysis of Profitability of Microfinance Institutions in Selected Asian Countries[1]

Karel JANDA[*] *Batbayar TURBAT*[**]

Abstract: This paper evaluates the effectiveness of some of the microfinance lending methodologies using the approach comparing these institutions among themselves in terms of how different lending methodologies influence their performance indicators. The results of this study with respect to different tested hypotheses are somewhat mixed but the general outcome is that rural lending and targeting women borrowers seem to have accomplished the goal whereas the effectiveness of group lending, in contrast to the initial expectation, was not confirmed.

JEL codes: G21, O16, P34.

[1] The authors acknowledge financial support from the Czech Science Foundation (grants number P402/11/0948 and P403/10/1235), from institutional support grant VSE IP100040 and from Internal Grant Agency of VSE (grant number IG102023). Karel Janda acknowledges research support provided during his long-term visits at Toulouse School of Economics, Australian National University and University of California, Berkeley and the supports he obtains as an Affiliate Fellow at CERGE-EI. The views expressed here are those of the authors and not necessarily those of our institutions. All remaining errors are solely our responsibility.

[*] Karel Janda, University of Economics, Faculty of Finance and Accounting, W. Churchill Sq. 4 130 67 Prague 3, Czech Republic; Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies, Opletalova 26, 110 00 Prague 1, Czech Republic; Affiliate Fellow at CERGE-EI, Politických vězňů 7, 111 21 Prague 1, Czech Republic; e-mail: Karel-Janda@seznam.cz

[**] Batbayar Turbat, University of Economics, Faculty of Finance and Accounting, W. Churchill Sq. 4 130 67 Prague 3, Czech Republic; e-mail: batbayar.t@gmail.com

Introduction

The goal of this paper is to study the impact of the microfinance methodologies on the portfolio risk, portfolio yield and the profitability of microfinance institutions by comparing the subgroups of the microfinance institutions which use different methodologies. In general microfinance institutions differ from one another in terms of the lending methodologies. These microfinance institutions can be divided up to several groups according to the methodologies such as institutions targeting women, institutions providing group loans, institutions serving rural areas, institutions providing individual loans only etc. Methodologies, which this paper focuses on, are group lending, targeting women borrowers and lending to rural borrowers (where social bound is expected to be stronger due to borrowers' interdependency). However, it is useful to note that only microfinance institutions are involved in this research, thus only relative effectiveness of such methodologies is to be studied. The outcome of this study, therefore, can only suggest how effective the studied methodologies are in comparison to the rest of microfinance institutions. It does not say anything about how effective these methodologies are in comparison with the conventional banking in terms of portfolio risk. For instance, individual loan in microfinance terms could mean a different product thanks to the alternative approach to collateral.

Empirical model

As stated above this study seeks to test whether the implementation of group loan, targeting women or village lending decreases or at least avoids the increase of risk of portfolio. Even though these methodologies are the main subject of this paper, other institutional factors and macroeconomic variables are also important in determining the risk.

The following hypotheses are made in this paper and are subject to research:

Hypothesis 1: Group lending decreases the default risk of the portfolio.

Armendáriz and Morduch (2005) suggest that group lending decrease the risk of default thanks to the formation of groups with individuals of the same type. That is risky borrowers form groups with risky borrowers and safe borrowers with same borrowers. The Grameen

Bank is based mainly on this idea. However, Gine, Karlan, Jakiela and Morduch (2005) show in their experimental study of microfinance that group loan may actually make the borrower to take on riskier projects than they would otherwise choose. Authors argue that group lending facilitate profitable risk taking while maintain high rates of loan repayment. In other words, implicit insurance mechanism imposed by group loan helps avoid greater default risk for the whole group.

Hypothesis 2: targeting women borrowers can help reduce the portfolio risk.

Targeting the woman borrowers is one of the building blocks of microfinance. Women are deemed to be more reliable and responsible borrowers than men (Armendáriz and Morduch (2005)). According to these authors, we should be able to see better repayment rate or lower portfolio risk with the increase of portion of women borrower. Also Barr and Kinsey (2002) found in their study that men are more likely to behave anti-socially, which may be the cause of lower repayment rate by men.

Hypothesis 3: activities in rural areas are expensive. Therefore, it is likely to decrease the performance in terms of portfolio risk, portfolio yield and profitability.

Lending to rural population has always been a struggle e.g. due to the density of the population. Low density and weak infrastructure could lead to poor screening, monitoring and collection activities. However, it might not always be true that rural lending will lead to negative results in terms of portfolio risk thanks to the innovations such as village banking.

Hypothesis 4: Good governance can lead to better performance in terms of portfolio risk and earning performance.

Papers such as Coleman and Osei (2008), and Mersland and Strom (2009) argue that good governance contribute to good performance. In contrast to these authors, we will use as an indicator of good governance the legal entity of individual microfinance institutions. Armendáriz and Morduch (2005) point out that the non-profit bodies are less successful in enforcing the loan conditions and managing the portfolio risk. Moreover, Dokulilová, Janda and Zetek (2009) point out that MFIs face problems in areas such as ethics, management, legal entity and other uncontrollable surroundings. Therefore, we will test the hypothesis that

the banks and non-bank financial institutions are most effective and NGOs are the least effective in terms of portfolio management and earning performance.

Based on the hypotheses the following dependent and independent variables are chosen and the first empirical model to be studied is as follows.

$$par_{ijt} = \alpha + \beta_1 per\_group_{ijt} + \beta_2 per\_rural_{ijt} + \beta_3 female_{ijt} + \delta_1 nbfi_i + \delta_2 cu_i + \delta_3 bank_3 + \theta V_{ijt} + \varepsilon_{ijt}$$

Table 1: Dependent and independent variables explained

Dependent and independent variables	Description
par_{ijt}	The portfolio risk of microfinance institution *i* in country *j* in period *t*
per_group_{ijt}	Percent of outstanding loans disbursed as group loans by institution *i* in country *j* in period *t*
per_rural_{ijt}	Percent of outstanding loans made to rural customers by institution *i* in country *j* in period *t*
$female_{ijt}$	Percent of women borrowers in institution *i* in country *j* in period *t*
$nbfi_i$	Dummy for institutions in the form of nonbank financial institution
cu_i	Dummy for credit unions
$bank_i$	Dummy for banks
num_bor_{ijt}	Number of outstanding borrowers
ave_size_{ijt}	Average loan size in USD for institution *i* in country *j* in period *t*
$growth_{jt}$	Growth rate of the economy in country *j* in period *t*
$inflation_{jt}$	Inflation in country *j* in period *t*

In this study as a measure of the risk of MFI is used a ratio of loans overdue by more than 30 days to the total loan portfolio, which is called portfolio at risk (*PAR>30*). First of independent variables are the percent of outstanding loan disbursed in a group loan form, the percent of outstanding loans disbursed to rural customers, the share of women borrowers served by the *i*-th microfinance institution in county *j* in time *t*, and dummies for the legal

form of microfinance *i*. The constant of the regression α represents the average risk of portfolio lent to men for all the microfinance institutions in the form of NGO given that only individual and non-rural loans are disbursed when other institutional and macroeconomic variables are controlled for. Vectors of coefficients β and δ are of the major interest in this study.

$$\beta = (\beta_1, \beta_2, \beta_3); \qquad \delta = (\delta_1, \delta_2, \delta_3)$$

β_1 is expected to be non-positive under assumption that group lending is effective in reducing the level of the risk. The reason for an expected non-positive or not a negative sign is the fact that individual loans in this study are actually microfinance loans. As microfinance individual loans are compared to group loans we can accept non-positive sign as success. The coefficient β_2 is associated with rural lending and expected to be positive due to the difficulty to operate in rural areas. As women borrowers are said to be more responsible, a greater presence of women among borrowers should drive the average level of risk down. Therefore, β_3 is expected to have a negative sign.

All of the δs are expected to have negative signs since NBFIs, CUs and banks are expected to have better governance thanks to their profit driven operations. Banks are expected to perform the best among all forms among others due to its size, which enables better diversification. Credit unions are expected to have in magnitude the second large coefficient because they can receive savings which can facilitate financial behavior of the borrowers. NBFIs are expected to perform somewhat better than NGOs as NBFIs are expected to make profits.

θ is a vector of coefficients for institutional and macroeconomic variables. Institutional characteristics, which can have impact on the risk, are the number of borrowers of each microfinance institution, an average loan size of the each institution and average yield. As these microfinance institutions are subject to economic environment in different countries, macroeconomic variables in country *j* in *t* period such as economic growth and inflation (represented by deflator) need to be controlled. Rewriting the empirical model from the half vector form will result in:

$$\theta = (\theta_1, \theta_2, \theta_3, \theta_4);$$

$$par_{ijt} = \alpha + \beta_1 per\_group_{ijt} + \beta_2 per\_rural_{ijt} + \beta_3 female_{ijt} + \delta_1 nbfi_i + \delta_2 cu_i + \delta_3 bank_i + \theta_1 num\_bor_{ijt} + \theta_2 ave\_size_{ijt} + \theta_3 growth_{jt} + \theta_4 inflation_{jt} + \varepsilon_{ijt}$$

The number of outstanding borrowers of microfinance institution *i* in country *j* in period *t* is represented by the variable num_bor_{ijt}. We assume that the bigger the portfolio gets the more it will be diversified. Therefore, the sign of θ_1 is expected to be negative. Another institutional variable ave_size_{ijt} is an average loan size. The expected sign of the coefficient for this variable is ambiguous as smaller loans can be easier to repay and, however, at the same time smaller loans will not allow entrepreneurial activities in a greater extent, thus lowering the borrowers' ability to repay.

Variable $growth_{jt}$ is the growth rate of the economy. When the economy is running smoothly and growing, also the businesses of microfinance borrowers are expected to thrive, which means the earnings of borrowers should increase and thus the likelihood of default should decrease. Therefore, the expected sign for the coefficient is negative. The last variable – GDP deflator represents inflation in the economy. The effect of inflation on the low income borrowers seem to be ambiguous. Inflation is known to have reallocating effect in favor of borrowers. However, this is valid only if the earnings of the borrowers rise with inflation fast enough.

Data

The data used in this research is collected from an open database MIX Market where microfinance institutions upload their financial information and other microfinance related information. Because MIX Market platform does not allow complex work with the data uploaded, the data was be manually downloaded and recompiled to fit the research goal we have imposed. Moreover, World Bank databank was used for macroeconomic data. The data is enclosed in an electronic form on a CD-ROM that can be found at the back of this paper. The consequent data used for the research is an unbalanced panel data of 90 microfinance institutions in the proximity of the Central Asian region over the period from 1998 to 2011. It

should be noted that the this time frame is kept only because of the fact that macros, which were used to rework the raw data, were set for this period at the beginning and in fact most of the observations are missing for the early years. However, this should represent a big issue as the statistical program used for analyses is capable of removing observations that have missing entries. The countries where the studied microfinance institutions operate are China, Mongolia, Kazakhstan, Tajikistan, Kyrgyzstan, Uzbekistan, Azerbaijan and Afghanistan. Microfinance institutions from these countries were chosen according to the completeness of the data they provide on MIX Market. Descriptive statistics for the compiled, after removal of certain errors, are presented in the following table. Two observations had values which were out of the possible range for per_group and per_rural.

Table 2: Descriptive statistics

Variable	Number of observations	Mean	Standard deviation	Min	Max
par	532	0.029	0.058	0	0.477
yield	342	0.354	0.152	0.053	1.142
roa	472	0.033	0.124	-1.045	0.405
per_group	352	0.159	0.310	0	0.998
per_rural	352	0.247	0.353	0	1
female	531	0.513	0.246	0.019	1
num_bor	595	15625	39921	4	411833
ave_size	592	2477.18	8786.92	0	171473.4
growth	1138	0.083	0.057	-0.019	0.345
inflation	1138	0.142	0.135	-0.188	0.878

As a result of incomplete data provided by MFIs the number of observations for the individual variables varies greatly. Despite this, the size of observation appears to be sufficient for answering the research questions.

As we see in the table above the highest portfolio at risk over 30 days is around 48 percent while the average portfolio at risk is 2.9 percent. Furthermore, the statistics reveal that there are microfinance institutions which offer only individual loans and also institutions operating solely in urban areas. Microfinance institutions studied range from very small to large in terms of the number of outstanding borrowers.

As stated before, the data is for 90 MFIs from the proximity of Central Asia. Below is the list of these MFIs which are included in this study.

Table 3: The list of MFIs

MFID	Name	Country	Type
1	CFPA	China	NGO
2	CZWSDA	China	NGO
3	Patra hunchun	China	NGO
4	ARDPAS	China	NGO
5	Patra yanbian	China	NGO
6	Microcred-Nanchong	China	NBFI
7	Rishlenglong	China	NBFI
8	Harbin Bank	China	Bank
9	Khan Bank	Mongolia	Bank
10	Credit Mongol	Mongolia	NBFI
11	Xac Bank	Mongolia	Bank
12	VFM	Mongolia	NBFI
13	TFS	Mongolia	NBFI
14	Hugjil badrah	Mongolia	NBFI
15	KMF	Kazakhstan	NBFI
16	FCF Shymkent	Kazakhstan	NBFI
17	Bereke	Kazakhstan	NGO
18	A-invest	Kazakhstan	NBFI
19	ORTA Nesie	Kazakhstan	NBFI
20	FFSA	Kazakhstan	NBFI
21	Arnur Credit	Kazakhstan	NBFI
22	NKCK LLC	Kazakhstan	NBFI
23	KFOND	Kazakhstan	NBFI
24	TAT Senim	Kazakhstan	NBFI
25	PF Damu	Kazakhstan	NBFI
26	MCO OZAT	Kazakhstan	NBFI
27	Sator	Kazakhstan	NBFI
28	ASF	Kazakhstan	NBFI
29	Baspana	Kazakhstan	NBFI
30	Orda Credit	Kazakhstan	NBFI
31	Altyn Orda	Kazakhstan	NBFI
32	Abzal Kredit	Kazakhstan	NBFI
33	Arbat	Kazakhstan	NBFI
34	Moldir	Kazakhstan	NBFI
35	Atyrauski Microfinance Center	Kazakhstan	NBFI
36	IMON	Tajikistan	NBFI
37	ASTI	Tajikistan	NBFI
38	OXUS-TJK	Tajikistan	NBFI
39	MDO Arvand	Tajikistan	NBFI
40	MLO HUMO	Tajikistan	NBFI
41	Borshud	Tajikistan	NGO

42	Agroinvestbank	Tajikistan	Bank
43	JOVID	Tajikistan	NBFI
44	Bank Eskhata	Tajikistan	Bank
45	FINCA-TJK	Tajikistan	NBFI
46	MLO Mehnatobod	Tajikistan	NBFI
47	Imkoniya Hovar	Tajikistan	NBFI
48	FMFB-TJK	Tajikistan	Bank
49	Tojsodirotbank	Tajikistan	Bank
50	Poenix+	Tajikistan	NBFI
51	Basi Tushum	Kyrgyzstan	NBFI
52	Aiyl Bank	Kyrgyzstan	Bank
53	FMCC	Kyrgyzstan	NBFI
54	Elet-Capital	Kyrgyzstan	NBFI
55	Mol Bulak Finance	Kyrgyzstan	NBFI
56	CU Timur TSD	Kyrgyzstan	CU
57	CU ABN	Kyrgyzstan	CU
58	FRP	Kyrgyzstan	NBFI
59	Kompanion	Kyrgyzstan	NBFI
60	First Microcredit Company	Kyrgyzstan	NBFI
61	Agrocredit Plus	Kyrgyzstan	NGO
62	OXUS-KGS	Kyrgyzstan	NBFI
63	BTA Bank	Kyrgyzstan	Bank
64	Mikrokredit Bank	Uzbekistan	Bank
65	ASR	Uzbekistan	CU
66	Sarbon	Uzbekistan	CU
67	Daulet	Uzbekistan	NGO
68	FVRM	Uzbekistan	NGO
69	Omni Finance	Azerbaijan	NBFI
70	Viator	Azerbaijan	NBFI
71	AccessBank	Azerbaijan	Bank
72	Azercredit	Azerbaijan	NBFI
73	Aqroinvest	Azerbaijan	CU
74	Azeri Star	Azerbaijan	NBFI
75	Normicro	Azerbaijan	NBFI
76	KredAqro NBCO	Azerbaijan	NBFI
77	FinDev	Azerbaijan	NBFI
78	DemirBank	Azerbaijan	Bank
79	Komak Credit	Azerbaijan	CU
80	Caspian Invest	Azerbaijan	NBFI
81	FINCA-AZE	Azerbaijan	NBFI
82	Parabank	Azerbaijan	Bank
83	Bank of Baku	Azerbaijan	Bank
84	TBC Kredit	Azerbaijan	NBFI
85	FMFB-AFG	Afghanistan	Bank

86	WWI-AFG	Afghanistan	NBFI
87	FINCA-AFG	Afghanistan	NBFI
88	OXUS-AFG	Afghanistan	NBFI
89	MADRAC	Afghanistan	NBFI
90	ASA_AFG	Afghanistan	NGO

MFID stands for Microfinance institution identity number. The numbering is the same as in the data file, which were used for below analyses. These particular MFIs are chosen due to the completeness of the data provided. In other words these MFIs provided more complete data relative to the rest of MFIs, which were not included in this study.

There are 8 MFIs based in China, 6 MFIs based in Mongolia, 21 MFIs based in Kazakhstan, 13 MFIs based in Kyrgyzstan, 15 MFIs based in Tajikistan, 6 MFIs based in Afghanistan, 16 MFIs based in Azerbaijan and 5 MFIs based in Uzbekistan included in this study. Of which, 58 are nonbank financial institutions, 15 are banks, 6 are credit unions and 11 are non-governmental organizations.

Table 4: Descriptive statistics for NGOs

Variable	Number of observations	Mean	Standard deviation	Min	Max
par	61	0.013	0.025	0	0.142
yield	41	0.269	0.173	0.087	0.761
roa	55	0.053	0.107	-0.223	0.405
per_group	42	0.144	0.330	0	0.958
per_rural	42	0.381	0.446	0	1
female	59	0.768	0.270	0.165	1
num_bor	71	5229	10088	53	67241
ave_size	71	411.12	397.30	0	2911.26

Table 5: Descriptive statistics for CUs

Variable	Number of observations	Mean	Standard deviation	Min	Max
par	31	0.011	0.014	0	0.066
yield	15	0.320	0.209	0.055	0.711
roa	24	0.083	0.052	0.001	0.213
per_group	15	0	0	0	0
per_rural	15	0.242	0.335	0	1
female	29	0.356	0.140	0.200	0.658

num_bor	31	998	924	24	3052
ave_size	31	1621.82	785.49	448.38	3375.13

Table 6: Descriptive statistics for NBFIs

Variable	Number of observations	Mean	Standard deviation	Min	Max
par	347	0.033	0.064	0	0.477
yield	219	0.398	0.141	0.053	1.142
roa	299	0.028	0.147	-1.045	0.365
per_group	228	0.209	0.340	0	0.998
per_rural	228	0.236	0.342	0	1
female	363	0.525	0.221	0.043	1
num_bor	388	10003	20649	4	137310
ave_size	387	2579.28	10572.71	0	171473.4

Table 7: Descriptive statistics for Banks

Variable	Number of observations	Mean	Standard deviation	Min	Max
par	93	0.034	0.059	0	0.410
yield	67	0.271	0.089	0.061	0.569
roa	94	0.025	0.031	-0.078	0.121
per_group	67	0.037	0.129	0	0.878
per_rural	67	0.204	0.313	0	1
female	80	0.331	0.181	0.019	0.898
num_bor	105	47745	78421	321	411833
ave_size	103	3775.20	4372.64	19.68	23681.46

Here will be presented few preliminary findings we see in tables above. There are several differences among the types of institutions. First of all, the average portfolio at risk is significantly higher in NBFIs and banks. In terms of number of outstanding borrowers CU and NGOs are smaller on average. All of the types of institutions offer rural lending. Targeting women is the most evident among NGOs. Group lending is provided by NBFIs, NGOs and banks. On average the smallest loans are provided by NGOs followed by CUs, NBFIs and banks.

These countries and MFIs were chosen to be included in the study because of several characteristics. Firstly, similar history and economic and political development were experienced by these countries. Moreover, microfinance initiatives in these countries are new. Introduced in the late 90s of the last century its implementation process had attracted significant amount of attention and effort.

Results

Estimation of the first empirical model

We will start with a simple OLS regression, where the dependent variable is Portfolio at Risk >30 days and explanatory variables are the percent of group loans, the percent of rural loans, the share of women borrowers, dummies for the legal forms, the number of total outstanding borrowers, average loan size, yield on gross portfolio, GDP growth rate and GDP deflator.

Table 8: Results of robust OLS regression

	Dependent variable: *par*	
Variable	Estimated value	P-value
per_group	0.031**	0.037
per_rural	0.000	0.969
female	-0.001	0.948
nbfi	0.018***	0.008
cu	0.001	0.932
bank	0.029**	0.038
num_bor	-2.04e-07	0.184
ave_size	3.52e-06*	0.077
growth	-0.092*	0.081
inflation	-0.051*	0.086
constant	0.022	0.229

*** - statistically significant at 1% level

** - statistically significant at 5% level

* - statistically significant at 10% level

Table 9: F-statistic and the coefficient of determination

	Value
Number of observations	319
F(10, 308)	3.71***

P-value	0.000
R-squared	0.103

In spite of a relatively small value of coefficient of determination (R-squared = 0.103), F-statistic of the estimation suggests that the model is significant. That is the null hypothesis that

$$H_o: \beta_1 = \beta_2 = \beta_3 = \theta_1 = \theta_2 = \theta_3 = \theta_4 = \delta_1 = \delta_2 = \delta_3 = 0$$

is rejected at 5% level because P-value is well below 0.05.

Looking at the p-values in the case of *per_rural*, *female, num_bor and cu* we cannot reject the null hypotheses that individual coefficients of these variables are statistically indifferent from null. In other words, on the contrary to the expectations, the percent of rural loans, the percent women borrowers and the number of outstanding borrowers do not influence the portfolio risk statistically significantly. It is worth noting that while group lending is increasing the portfolio risk, rural lending does not increase the risk. This might be a result of stronger bound among the rural customers (Wydick (1999)).

When it comes to the legal form of the microfinance institution credit, having a legal form of credit union statistically do not differ from having a form of NGO. Therefore, we should check if we can eliminate all these insignificant variables from the model using joint significance test.

The null hypothesis is

$$H_o: \beta_1 = \beta_2 = \beta_3 = \theta_1 = \delta_2 = 0$$

Using F-test for joint significance of the above variables:

Table 10: F-test results

	Value
F(4, 308)	0.51
P-value	0.730

Since the p-value is well above of 0.05, we cannot reject the null hypothesis that these variables are jointly in significant in the model.

Eliminating insignificant variables result in the following estimation.

Table 11: Results of robust OLS regression after elimination of insignificant variables

	Dependent variable: *par*	
Variable	Estimated value	P-value
per_group	0.029*	0.059
per_rural	dropped	
female	dropped	
nbfi	0.017***	0.001
cu	dropped	
bank	0.022***	0.001
num_bor	dropped	
ave_size	3.94e-06*	0.051
Growth	-0.087*	0.053
Inflation	-0.047	0.102
Constant	0.019***	0.002

*** - statistically significant at 1% level

** - statistically significant at 5% level

* - statistically significant at 10% level

Table 12: F-statistic and the coefficient of determination

	Value
Number of observations	336
F(6, 329)	5.86***
P-value	0.000
R-squared	0.098

P-value for the F-statistic suggests that model is statistically significant. The coefficient of determination has decreased slightly as the number of variables in the model was cut by four.

From the table above we see that the hypotheses presented at the beginning of this paper were not confirmed by this study. The first hypothesis was that the group lending helps decrease portfolio risk. The estimate of coefficient on *per_group* came out positive and statistically significant opposed to the expectation that it will be null or slightly negative. One percentage increase of share of group loans in the total loan portfolio leads to an increase of portfolio at risk >30 days by 0.029 percent. We should be very careful with drawing conclusion here as the seemingly positive group lending to risk relationship can be a mere result of the selection of borrowers for the group lending. It is important to note that microfinance clients differ in

terms of their economic background. Some households are very poor while some are rather poor but owns assets. Group lending is usually used when there is very little or no assets that can be used as collateral. So the microfinance institutions might choose these borrowers to form groups, within which all other member of the same group will be responsible for the repayment by one of the borrowers. The selection is also done on the borrowers' side as well. Group lending is costly for the borrowers because one has to attend meetings and also pay attention to the activities of other group members in order not be forced to repay for them. Thus a borrower will choose an individual loan if he or she can. All these selections might mean that the borrowers, who are receiving loans through a group, are the poorest of the all and have no other alternative. Therefore, group lenders are inherently riskier than the individual lenders are. In other words, it can be that group lending does not raise the level of risk in microfinance institutions and the estimation is only reflecting the fact group lenders are riskier. In addition, it can be a mere proof of very poor borrowers receiving group loans. Therefore, it is important in the next step to study how much group lending is decreasing the default risk, if it does, in very poor borrowers compared to hypothetical default risk of individual loans among these borrowers.

Based on empirical research, D'Espallier, Guérin, And Mersland (2011) came to a conclusion that repayment rate of women borrowers is higher. However, both variables *female* and *per_rural* are not statistically significant in this model when controlled for other variables. According to this, targeting women population and lending in the rural areas do not seem to have impact on the risk of loan portfolio. That is the statement women are more reliable borrowers and rural customers are less reliable borrowers in terms of repayment rate was not confirmed by this study. However, the differences, if any, may be reflected in the earning performance (interest rate) of MFIs. That is because the risk of higher default risk of risky groups (men borrowers and rural borrowers) may be addressed by MFIs through increased effort in monitoring/collecting the loans, which can be evident in the increased expenses and thus in lower profits.

The hypothesis that the microfinance institutions with a bigger base of outstanding borrowers should be able to better diversify and thus should have a lower level of portfolio risk was not confirmed. It appears that the number of borrowers does not seem to affect MFIs' ability to manage the default risk of borrowers. Moreover, having a legal entity of NGO or CU does not

seem influence their portfolio risk. That may be because they are serving relatively small and closed groups of people.

Interestingly, NBFIs and banks have a higher portfolio risk on average. This seems to be somewhat opposing the hypothesis that NBFIs and NGO should have better governance, which should result in a better management of loan portfolio. NBFIs have on average 0.017 percentage points higher PAR>30 in comparison to NGOs, whereas banks have 0.022 percentage points higher PAR>30. It appears that the more commercial an institution becomes the bigger portfolio risk becomes. However, the bigger value of PAR>30 does not necessarily mean that the portfolio management is worse than in other forms of MFIs. In fact it can be that NGOs might be committing unnecessarily to a level of risk, which is too low.

At last, as expected both growth rate and inflation (however, with relatively low levels of confidence) seem to be facilitating the ability of the borrowers to repay, which resulting in a lower level of risk of portfolio. Growth was also found to be facilitating the performance of MFIs through a lower level of default by Ahlin, Lin and Maio (2011).

Using a link test in STATA we can tell how well the model fits the data. This simple test of model fit is a regression of the dependent variable on the prediction and the square of prediction. If the model is specified correctly, then the coefficient on the prediction should be close to 1 and the coefficient for the square of prediction should not be statistically significant. In other words, the square of prediction should have no explanatory power. The following table contains the result of the link test.

Table 13: Test for misspecification

	Dependent variable: *par*	
Variable	Estimated value	P-value
$\widehat{par}$	1.034**	0.021
$\widehat{par}^2$	-0.456	0.936
constant	-0.000	0.957

$\widehat{par}$ is the prediction of *par* and $\widehat{par}^2$ is the square of prediction. As we can see from the table, the null hypothesis that the coefficient for the prediction squared is equal to zero cannot be rejected. In other words the model fit test suggests the model is correctly specified.

Estimation of the second empirical model

The second model to be studied in this research looks as follows:

$$yield_{ijt} = \alpha + \beta_1 per\_group_{ijt} + \beta_2 per\_rural_{ijt} + \beta_3 female_{ijt} + \delta_1 nbfi_i + \delta_2 cu_i + \delta_3 bank_i + \theta_1 num\_bor_{ijt} + \theta_2 ave\_size_{ijt} + \theta_3 growth_{jt} + \theta_4 inflation_{jt} + \varepsilon_{ijt} + \varepsilon_{ijt}$$

Independent variables of this model are the same as in the first model. Only the dependent variable is *yield* instead of *par.* The variable *yield* stands for the earning performance of individual MFI, which is expressed by the yield of the gross loan portfolio. However even it is called portfolio yield, it is more of lending related revenue expressing the earning performance of a MFI. Yield is used in this study together with PAR>30 and ROA so that we can tell apart what kind of effect individual methods have.

In the following table is presented the estimation of the model.

Table 14: Results of robust OLS estimation

	Dependent variable: *yield*	
Variable	Estimated value	P-value
per_group	0.055**	0.020
per_rural	-0.059**	0.020
female	0.122***	0.001
nbfi	0.152***	0.000
cu	0.119**	0.049
bank	0.087***	0.008
num_bor	-4.13e-07***	0.007
ave_size	-9.65e-06***	0.001
growth	-0.248**	0.035
inflation	0.236***	0.001
constant	0.198***	0.000

*** - statistically significant at 1% level

** - statistically significant at 5% level

* - statistically significant at 10% level

A more clear/direct relationship is evident in the model above. The coefficients of all variables are statistically significant.

Table 15: F-statistic and the coefficient of determination

	Value
Number of observations	311
F(10, 300)	19.79***
P-value	0.000
R-squared	0.267

According to the F-statistic the model is significant and explains 26.7 percent of the variation in the dependent variable. With respect to the number of observation the coefficient of determination is acceptable.

Table 16: **Test for misspecification**

	Dependent variable: *yield*	
Variable	Estimated value	P-value
$\widehat{yield}$	0.916	0.206
$\widehat{yield}^2$	0.120	0.907
constant	0.014	0.911

From the table we can see that the null hypothesis that the coefficient for the prediction squared is equal to zero cannot be rejected (p-value=0.907). Thus link test above suggests that the model is specified correctly. Therefore we can now go to the individual variables and interpret the result.

Hypotheses, which were made, seem to be confirmed partially at this point. The coefficient for the variable *per_group* is statistically significant and different from zero, which means that this variable is relevant in explaining the earning performance. It suggests that an increase in the share of group loans in the whole portfolio by 1 percentage point leads to an increase in the yield of the gross loan portfolio by 0.055 percentage points. In other words, group loans appear to produce higher revenue than then individual loan at this point. This may be done through higher interest. However, one should note that this higher revenue is coming at the cost of higher portfolio risk (please refer to the results of the first estimation).

From the first estimation the contribution of risk to the rural households and male borrowers to the portfolio risk was not evident. However, from the model above we see that lending to the rural areas seems to be decreasing the earning performance of MFIs according to the OLS estimate. On average an increase in the share of rural loans by 1 percentage point lead to a decrease of the yield of the gross loan portfolio by 0.059 percentage point. Also, lending to

women borrowers seems to increase the yield, which again seems to be elevated interest rates for this group.

The hypothesis that NBFIs, CUs and banks should perform better in comparison to NGOs in terms of ability to produce revenue was confirmed in this study. On average banks have 8.7 percent higher, CUs 11.8 percent higher and NBFIs 15.2 percent higher yield of the gross loan portfolio. One of the reasons of current transformation of NGOs to these types of institutions seems to be earning performance, which is easier to achieve with good governance.

The estimated model suggests that with an increase of number of borrowers average yield decreases. Moreover, it seems that the bigger the loans grow the lower the yield of the gross loan portfolio becomes. It is possible that with the growth of size loans and the number of borrowers microfinance institutions might be forced to compete with conventional bank and this fact might be making MFIs act more like conventional banks. However, this can true only given that conventional banking sector has lower interest rates.

It is also interesting that with the growth of the economy the yield of the gross loan portfolio decreases and vice versa. Under assumption that the performance of these local economies is positively correlated with the global economy, this result seems to be in line with the findings of Janda and Svárovská (2012). These authors point out that returns on investment in microfinance investment funds are not positively correlated with returns on the market portfolio.

Estimation of the third model

The variable ROA is chosen because as the final measure of financial performance of an organization it captures more details in comparison to PAR>30 and yield. For instance, the risk of portfolio may be controlled through different measures and methodologies. However, at the end elevated effort will be visible on ROA. In other words third model is used to create a more complete picture of the MFI activities.

$$roa_{ijt} = \alpha + \beta_1 per\_group_{ijt} + \beta_2 per\_rural_{ijt} + \beta_3 female_{ijt} + \delta_1 nbfi_i + \delta_2 cu_i + \delta_3 bank_i + \theta_1 num\_bor_{ijt} + \theta_2 ave\_size_{ijt} + \theta_3 growth_{jt} + \theta_4 inflation_{jt} + \varepsilon_{ijt}$$

Only dependent variable is changed to ROA and the independent variables stay the same as in the first two models. We should be able to see from the result how expensive individual methods are and how the rest of the variables affects the profitability. The table below contains the OLS estimates.

Table 17: Results of robust OLS estimation

	Dependent variable: *roa*	
Variable	Estimated value	P-value
per_group	-0.027	0.240
per_rural	0.011	0.523
female	0.037	0.354
nbfi	-0.027	0.240
cu	0.022	0.389
bank	-0.033	0.176
num_bor	2.58e-07	0.193
ave_size	3.30e-06**	0.045
growth	0.053	0.504
inflation	0.228***	0.002
constant	-0.016	0.701

*** - statistically significant at 1% level

** - statistically significant at 5% level

* - statistically significant at 10% level

A more clear/direct relationship is evident in the model above. The coefficients of all variables are statistically significant.

Table 18: F-statistic and the coefficient of determination

	Value
Number of observations	312
F(10, 300)	2.98
P-value	0.058
R-squared	0.121

According to the F-statistic the model is not statistically significant at a 0.05 level. All coefficients except average loan size and inflation are statistically no different from zero. In the following section the model will be estimated using different techniques. At this point positive relationships exit between ROA and average loan size or inflation.

Estimation of the models using panel data techniques

At this point we should recall that the data being used in this chapter is actually panel data. Panel data is a dataset in which entities are observed across time. My data consist of 90 entities, for which exist observations (though incomplete) over the period from 1998 to 2011. In other words, it is a combination of times series for each of the observed entities. Up to this point, the analyses were carried out using OLS regression, which treats each observation as individual observation ignoring the time series property. The OLS regression used in this way is called pooled OLS regression. However, this may be inefficient use of data as the main advantage of panel data is the fact that unobservable variables and factors can be controlled for given that they are significant. These unobservable factors can be, for instance, corporate cultural differences among MFIs, some aspects of corporate governance, the public image of a certain institution, or a relationship with sponsors and regulatory bodies i.e. factors specific to an individual MFI. The common techniques of panel data are fixed effects model and random effects model. These techniques will be briefly introduced in the following text and will be followed by the estimation results for both theoretical models using random and fixed effect models.

Fixed effect model should be used when we believe that there are some time-invariant unobserved variables which have impact on independent variables. Fixed effect model can help us better explore the relationship between dependent and independent variables within a microfinance institution. Each institution has its own individual characteristics that may influence the independent variables e.g. the business practices of a certain microfinance institution may lead the borrower act more responsible or less responsible resulting in a higher or lower rate of default. It is worth noting assumption behind this model is that these characteristics are specific to an institution and time-invariant. In other words each institution is different, thus the error term and the constant which capture these characteristics should not be correlated with the each others. Fixed effect model removes the effect of those time-

invariant characteristics from the explaining variables so we can assess the effect of the explaining variables on the dependent variable.

In addition to the rationale behind fixed effect model, random effect model assumes that the variation across institutions is random and uncorrelated with the explaining variables included in the model. In other words, unobserved effects of institutions are not explainable by the independent variables in the model. Therefore, in contrast to fixed effect model unobserved effect is entered as an explaining variable in random effect model. The table below contains the estimates of the coefficient of all models using random and fixed effects.

Table 19: Random effect and fixed effect models

	Dependent variable: *par*		Dependent variable: *yield*		Dependent variable: *roa*	
	Random effect	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect
Dependent variables	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)
per_group	0.034*	0.037*	0.022	0.017	0.001	0.006
	(0.065)	(0.062)	(0.401)	(0.549)	(0.958)	(0.761)
per_rural	0.004	0.005	-0.011	-0.002	-0.012	-0.021
	(0.684)	(0.605)	(0.534)	(0.929)	(0.450)	(0.200)
female	0.017	0.051	0.270***	0.302***	0.124***	0.204***
	(0.598)	(0.393)	(0.001)	(0.006)	(0.004)	(0.000)
nbfi	0.026*	Omitted	0.183***	Omitted	-0.025	Omitted
	(0.061)		(0.005)		(0.549)	
cu	0.008	Omitted	0.211*	Omitted	0.062	Omitted
	(0.707)		(0.087)		(0.376)	
bank	0.045*	Omitted	0.158**	Omitted	-0.016	Omitted
	(0.058)		(0.030)		(0.756)	
num_bor	-1.65e-07	-2.5e-07	-6.95e-07*	-7.26e-07	4.82e-07*	8.17e-07**
	(0.210)	(0.141)	(0.075)	(0.229)	(0.060)	(0.013)
ave_size	3.03e-06	3.19e-06	-9.30e-06***	-12.1e-06***	7.14e-06**	9.63e-06**
	(0.293)	(0.564)	(0.008)	(0.009)	(0.019)	(0.017)
growth	-0.080	-0.077	-0.113	-0.085	0.125*	0.144*
	(0.161)	(0.277)	(0.231)	(0.389)	(0.092)	(0.062)
inflation	-0.046	-0.045	0.059*	0.035	0.073	0.041
	(0.147)	(0.209)	(0.084)	(0.299)	(0.103)	(0.372)
Constant	0.006	0.009	0.099	0.241***	-0.070	-0.124***

	(0.809)	(0.704)	(0.230)	(0.000)	(0.166)	(0.000)
Observation	319	319	311	311	312	312
Number of groups	76	76	76	76	74	74
Wald chi2 / F test	29.72	2.08	132.77	5.55	23.91	4.16
P-value	0.001	0.056	0.000	0.000	0.008	0.000

*** - statistically significant at 1% level

** - statistically significant at 5% level

* - statistically significant at 10% level

Omitted – omitted due to collinearity

The decision whether random effects or fixed effects should be used is made using Hausman test. The null hypothesis of Hausman test is that the preferred model is random effects opposed to the alternative hypothesis that fixed effect model should be used.

Table 20: Hausman test for the first model

	Dependent variable: *par*
Hausman test	4.06
P-value	0.541

Since the p-value is way above the significance level of 0.05, we cannot reject the null hypothesis that the preferred model is the random effect model. In other words, for the model, where the portfolio risk is explained, is suitable random effects technique.

Table 21: Hausman test for the second model

	Dependent variable: *yield*
Hausman test	19.23
P-value	0.002

At a 0.05 significance level, we reject the null hypothesis that the preferred model is random effects model in favor of alternative hypothesis that the fixed-effects model is preferred. Therefore, we should choose the fixed effects model for the case where the variable *yield* figures as the dependent variable.

Table 22: Hausman test for the third model

	Dependent variable: *roa*
Hausman test	24.81
P-value	0.000

At a 0.05 significance level, we can reject the null hypothesis that the preferred model is random effects model in favor of alternative hypothesis that the fixed-effects model is preferred. Therefore, we should choose the fixed effects model here.

In the following table we will see the result of pooled OLS compared to the estimates obtained using panel data techniques.

Table 23: Comparison of pooled OLS and fixed-effects/random effects model

	Dependent variable: *par*		Dependent variable: *yield*		Dependent variable: *roa*	
	Pooled OLS	Random effect	Pooled OLS	Fixed effect	Pooled OLS	Fixed effect
Dependent variables	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)	Estimate (P-value)
per_group	0.029* (0.059)	0.034* (0.065)	0.055** (0.020)	0.017 (0.549)	-0.027 (0.240)	0.006 (0.761)
per_rural	Dropped	0.004 (0.684)	-0.059** (0.020)	-0.002 (0.929)	0.011 (0.523)	-0.021 (0.200)
female	Dropped	0.017 (0.598)	0.122*** (0.001)	0.302*** (0.006)	0.037 (0.354)	0.204*** (0.000)
nbfi	0.017*** (0.001)	0.026* (0.061)	0.152*** (0.000)	Omitted	-0.026 (0.160)	Omitted
cu	Dropped	0.008 (0.707)	0.119** (0.049)	Omitted	0.022 (0.389)	Omitted
bank	0.022*** (0.001)	0.045* (0.058)	0.087*** (0.008)	Omitted	-0.033 (0.176)	Omitted
num_bor	Dropped	-1.65e-07 (0.210)	-4.13e-07*** (0.007)	-7.26e-07 (0.229)	2.58e-07 (0.193)	8.17e-07** (0.013)
ave_size	3.94e-06* (0.051)	3.03e-06 (0.293)	-9.65e-06*** (0.001)	-12.1e-06*** (0.009)	3.30e-06** (0.045)	9.63e-06** (0.017)
growth	-0.087* (0.053)	-0.080 (0.161)	-0.248** (0.035)	-0.085 (0.389)	0.053 (0.504)	0.144* (0.062)
inflation	-0.047 (0.102)	-0.046 (0.147)	0.236*** (0.001)	0.035 (0.299)	0.228*** (0.002)	0.041 (0.372)
Constant	0.019*** (0.002)	0.006 (0.809)	0.198*** (0.000)	0.241*** (0.000)	-0.016 (0.701)	-0.124*** (0.000)
observation	336	319	311	311	312	312
Number of groups		76		76		74

Wald chi2 / F test	5.86	29.72	19.79	5.55	2.98	4.16
P-value	0.000	0.001	0.000	0.000	0.058	0.000

For the model where the dependent variable is *par* estimates come out similar to each other for both techniques. All the variables which came out significant in OLS regression are also significant in the random effects model. Also the sign of all these variables are the same regardless of the estimation technique. Coefficients of the variables except variable *ave_size, growth* and *inflation* are relatively higher in magnitude in the case of random effects model. Therefore, all the conclusions drawn based on the result of OLS remain valid.

In the case of model where the dependent variable is *yield* again all the signs are the same for both fixed-effects and OLS. However, fixed-effects model returns that coefficient on the variables *per_group, per_rural* and *num_bor* are not significantly different from zero. These findings suggest that there were unobserved time-invariant variables specific to each MFIs, which resulted in the previous significance of variables *per_group, per_rural* and *num_bor.* The magnitude of the significant variables has also grown here. For instance, the coefficient for the female borrowers has increased from 0.122 to 0.302, which means the previous conclusion regarding targeting women remains the same. However, we now know that group loans and rural lending do not influence the yield. This means that group lending is despite its increased risk does not lead to a higher yield of the gross loan portfolio. In other words, group loan does not appear to be effective. When it comes to the rural lending, the insignificant coefficient actually works in its favor. It suggests that rural lending does not decrease the yield of the gross loan portfolio. This finding with previous finding that rural lending has no impact on the risk level suggests that the set of microfinance methodologies used in rural lending might be effective. However, we should wait for the impact of *per_rural* on ROA. At last we should note one disadvantage of fixed-effects model. That is the fact that we cannot study the impact of the legal form on the yield of the gross loan portfolio. Dummy variables used for this are omitted due to collinearity and the effect is absorbed by the individual interceptions of each institutions.

With the application of panel data technique the third model now looks statistically significant. Group lending and rural lending does not actually influence the profitability of the MFIs. This means that the study was not able to confirm that group lending differs from

individual lending in terms of final profitability. However, group lending appears to be increasing the risk of loan portfolio, which leads to a conclusion that it is actually ineffective. In contrast rural lending seems to have no effect on the risk, revenue and ROA. Thus it implies that it is actually indifferent from individual loan in urban areas. The conclusion is the rural lending is more effective then group lending partially thanks to higher social cohesion in the rural communities.

Targeting women seems to increase the profitability. Therefore, with previous findings it can be said that women bear less risk of default. However, when taken into account the findings that no effect on the default risk, higher yield and profitability, it may suggested that MFIs are actually making use of the low level of default risk of women by increasing the interest rate charged to women to the point where default risk equals that of men.

Coefficients on the number of borrowers and average loan size in the third model suggest that increasing number of borrows and loan size actually helps cut the costs significantly.

Results

We can close this paper by drawing conclusion for the studied region. Firstly, we are not able to draw a complete conclusion based on the legal entity forms. And the answer to the question of whether microfinance methodologies are effective is somewhat mixed. The hypothesis that the group lending decreases the portfolio risk in comparison to individual lending was not confirmed. This may be caused by the selection of type of loan by the borrowers and the lenders. Another finding is that targeting women and lending to the rural communities do not seem to increase the portfolio risk. Moreover, targeting women does increase the yield of the gross loan portfolio confirming that the men borrowers are worse deals for MFIs. In fact targeting women seems to work well as a tool of producing higher portfolio yield. In contrast rural lending does not seem influence the portfolio yield. At last it was found that group lending and rural lending does not influence the profitability measured by ROA. That is apart from the fact that these methodologies do not influence the portfolio yield they seem to have no influence on the expense side as well. Only targeting the women borrowers appears to be contributing to the profitability of MFIs. When these findings put together, targeting women and rural lending seem to be effective in contrast to group lending which appears ineffective.

References

Ahlin, C., Lin, J., & Maio, M. (2011). Where Does Microfinance Flourish? Microfinance Institution Performance in Macroeconomic Context. Journal of Development Economics, Volume 95, Issue 2, p 105–120

Armendáriz de Aghion, B., & Morduch, J. (2005). The Economics of Microfinance. The MIT press Cambridge, Massachusetts London, England.

Barr, A., & Kinsey, B. (2002). "Do men really have no shame?," CSAE Working Paper No.164.

Coleman, A.K., & Osei, K.A. (2008). Outreach and Profitability of Microfinance Institutions: the Role of Governance. Journal of Economic Studies, vol. 35, 236-248.

D'Espallier, B., Guérin, I., & Mersland, R. (2011). Women and Repayment in Microfinance: A Global Analysis. World Development, Volume 39, Issue 5, p 758–772.

Dokulilová, L., Janda, K., & Zetek, P. (2009).Sustainability of Microfinance Institutions in Financial Crisis.

Giné, X., Jakiela, P., Karlan, D., & Morduch, J. (2009). Microfinance Games. American Economic Journal: Applied Economics, American Economic Association, vol. 2(3), 60-95.

Janda, K., & Svárovská, B. (2012). Suitability of Microfinance as an Investment Option. Center for Economic Research and Graduate Education. Working Paper Series 470.

Mersland, R., & Strom, O. (2009). Performance and Corporate Governance in Microfinance Institutions. Journal of Banking and Finance, Vol. 33, pp. 662-669.

Wydick, W. B. (1999). Can Social Cohesion Be Harnessed to Repair Market Failures? Evidence from Group Lending in Guatemala. *The Economic Journal, 109,* 463–475.