Motivation

- 2005 was declared by the United Nations the International Year of Microcredit, in order to acknowledge the contribution that microcredit makes towards poverty reduction.

- The Nobel Peace Prize for 2006 was awarded to Muhammad Yunus, microfinance pioneer and founder of Grameen Bank.

- Microfinance institutions (MFIs) are not a rarity any more, but are becoming first-class members of financial and banking systems in developing countries.

- Their growing parameters are outstanding, both in number of firms and in number of clients.
MFIs focus on social matters: they give small loans, microcredits, to low income people excluded from conventional financial institutions. But they also perform financial tasks. MFIs have to submit themselves to performance assessments taking into account their dual nature: financial and social.

How can we measure the performance of MFIs? It is not enough to measure their financial performance in terms of profitability. How do we measure their social impact? Do we use social indicators? Both things should be done: there is a Double Bottom Line; Yaron (1994):

- First Bottom Line is financial; Adams and Von Pischke (1992)
- Second Bottom Line is social; Navajas et al. (2000), Dunford (2000)

Much has been studied in all kinds of institutions: banks, saving banks, cooperatives. Berger y Humphrey (1997) surveyed 130 papers from 21 countries.

An institution is efficient if it generates a high level of output with few inputs. This is a standard definition.

What inputs and outputs should be included? There are various views according to whether we look at financial institutions from the point of view of intermediation or from the point of view of production.
Intermediation and production models


![Intermediation Model Diagram]

Under the **production** model, financial institutions use human and physical resources in order to process transactions such as grant loans or capture deposits: Vassiloglou and Giokas (1990), Soteriou and Zenios (1999).

![Production Model Diagram]

**PRODUCTION FUNCTIONS**

[Diagram showing production functions with inputs and outputs labeled.]
DATA ENVELOPMENT ANALYSIS

\[
\sum_{k=1}^{K} x_k y_s 
\]

\[
\sum_{j=1}^{I} u_j x_i 
\]

Financial efficiency in MFIs. A production model

**INPUTS**

**Output 1**

- **Input A**
  - Number of employees (num.)

**Output 2**

- **Input B**
  - Physical assets ($)

- **Input C**
  - Operating cost ($)

- Revenue ($)

- Loans ($)
Social efficiency

- If an MFI is not financially efficient it will not survive long, but we soon realised that studying financial efficiency is not enough. These institutions have a social goal and this must also be assessed.
- There are methodologies aimed at rating MFIs: CAMEL, GIRAFE, M-Cril, Microfinanza, Microrate, MICROs and MIRACLES. But most rating agencies use the Standard and Poor’s approach and concentrate on financial aspects forgetting the social ones.

- 6 rating approaches partially incorporate social indicators: IMP-ACT, AIMS, SROI, Accion PAF, CGAP (PAT) and SPI.

Social efficiency modelling

- We use as outputs the impact on women and on poverty.
- The number of loans made to women is easy to obtain.
- But poverty is a relative concept. Who is poor?

- Given any two MFIs with identical inputs, the one that makes many small loans (small relative to the country’s per capita GNI) will be more socially efficient that the one that makes larger loans.

\[ K = \frac{\text{Average loan}}{\text{GNIpc}} \]

\[ p_i = 1 - \frac{K_i - \text{Min}(K)}{\text{Rank}(K)} \quad 0 < p_i < 1 \]

Output \( P = p_i \times \text{Number of customers} \)
Berger and Humphrey (1997) classify 132 papers according to the approach used:

- **Parametric** - Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA), Thick Frontier Approach (TFA).
- **Non-parametric** - Data Envelopment Analysis (DEA), Free Disposal Hull (FDH), Index Numbers (IN), Mixed Optimal Strategy (MOS).

**DEA** has not been used in MFIs.

**DEA** can be used when the conventional cost and profit functions cannot be justified.

**DEA**, used in 62 papers is the most popular approach.
DEA Mathematical formulation

\[
\begin{align*}
\text{Min} \quad & \Phi \\
\sum_j \lambda_j x_{jm} & \leq \Phi x_{j,m} \quad ; m = 1,2,\ldots,M \\
\sum_j \lambda_j y_{jn} & \geq y_{j,n} \quad ; n = 1,2,\ldots,N \\
\lambda_j & \geq 0 \quad ; j = 1,2,\ldots,J
\end{align*}
\]

Where:
- \( \Phi \): DEA efficiency inverse
- \( x_{jm} \): Value of input \( m \) from DMU \( j \)
- \( j_0 \): DMU whose efficiency is estimated
- \( y_{jn} \): Value of output \( n \) for DMU \( j \)
- \( \lambda_j \): Variable to be calculated from the data

Methodological contribution

- DEA is very sensitive to input/output selection. Adding or removing inputs and outputs can change a MFI from efficient to inefficient (or the other way round).

- DEA efficiency is just a number that provides very poor information. Two MFIs may have achieved the same level of efficiency but may have followed very different strategies.

- We estimate many specifications involving many combinations of inputs and outputs. We obtain a matrix of efficiencies by models that is later analysed by means of multivariate statistical techniques: Principal Components Analysis, Cluster Analysis, and Regression; Serrano and Mar Molinero (2004).

- Assessing DEA efficiency for each possible combination of inputs and outputs (21).

- Notation: Based on initials AE-W includes as inputs “Assets” and “Employees” and as output “Women”.
Sample and data: financial efficiency model

**INPUTS**

- Credit Officers (num.)
- Operating Expense ($)

**OUTPUTS**

- Interest and Fee Income ($)
- Gross Loan Portfolio ($)
- Number of loans (num.)

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### 30 Latin American MFIs

**DEA efficiency results**

<table>
<thead>
<tr>
<th>DMU</th>
<th>A1</th>
<th>A2</th>
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### www.microrate.com
The level of efficiency achieved by a particular MFI depends on the specification chosen. We will explore what is behind a DEA score.

The methodology involves treating specifications as variables and MFIs as cases in a Principal Components Analysis (PCA).

In order to interpret the meaning of the components we resort to the technique of Property Fitting (Pro-Fit), that draws lines in the figures pointing towards the value of the property increases.
PC 2 vs PC 3

DEA PC interpretation

- PC1: overall measure of efficiency that summarises all the models
- PC2: NGO status
- PC3: Inputs: Credit officers versus operating expenses
- PC4: Outputs: The inclusion or exclusion of the gross loan portfolio affects efficiency values
Non-Governmental Organizations

NGOs: Pro-Fit line B3: they try to make a large number of loans and operate as cheaply as possible.

Non-NGOs: Pro-Fit lines A1, A12, A2: they rely on their specialised staff to build a profitable portfolio of loans.

Country effect

Efficiency in building large portfolios
Conclusions

- We have used DEA to assess MFIs efficiency.
- Our methodological contribution goes beyond DEA measures and tries to explain differences between scores obtained under different models and specifications.
- We have obtained 4 efficiency PCs, each one of them related to a different aspect: global efficiency, NGO status, input selection and output selection.
- This way we can understand why a given MFI reach an efficiency score under a given specification, or what is the path to efficiency followed by a group of MFIs.

Empirical study. Social and Financial efficiency

- The data comes from Microfinance Information eXchange (www.mixmarket.org)
- 89 MFIs are included
- 2003 data from annual accounts and non-financial information.

<table>
<thead>
<tr>
<th>MF</th>
<th>Social &amp; Financial</th>
<th>Financial Efficiency</th>
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<td>Dem.</td>
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<td>peo</td>
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<td>non</td>
<td>31.45</td>
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<td>ngo</td>
<td>31.54</td>
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<tr>
<td>contr.</td>
<td>31.33</td>
<td>31.34</td>
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</tbody>
</table>
Social and financial efficiency

- Financial efficiency is needed for survival. Financially efficient MFIs are in a better position to perform their social tasks.
- The correlation between social efficiency (ACE-WP) and financial efficiency (ACE-LR) is significant but low at 0.346.
- The IV quadrant: socially efficient but financially inefficient is almost empty.
- Only in 13 out of 89 MFIs social efficiency is higher than financial efficiency.
- Then, socially efficient MFIs are also financially efficient.

MFIs efficiency in fighting poverty and supporting women

- We would expect that those institutions that are efficient at supporting the poor are also efficient at supporting women.
- Some MFIs aim solely at supporting poor women.
- The correlation coefficient between ACE-W (women efficiency) and ACE-P (poor efficiency) is 0.865.
- To sum up, socially efficient MFIs are efficient in fighting poverty and supporting women.
Type of MFI and efficiency

- MFIs can be banks, non-banking financial institutions, cooperatives, credit unions, and NGOs. NGOs emphasise the social aspects.
- 37 out of the 89 MFIs are NGOs.
- NGO have higher efficiencies in the 3 models associated with social efficiency: ACE-W, ACE-P y ACE-WP.

- Statistical testing based on differences of means (ANOVA and non-parametric).
- The only significant differences were associated with Women as an output.

Profitability and social efficiency

- The argument is that a MFI needs to be profitable in order to survive, and that profitable MFIs are so because they are good at supporting viable projects.
- But it can also be argued that MFIs are not profit maximising institutions.
- Profitability has been measured through two financial ratios: (ROA) economic profitability and (ROE) financial profitability.

- The correlation between social efficiency measures and profitability, although positive, is low and never significantly different from zero.
- We have not found any significant relationship between profitability and social efficiency.
Age and social efficiency

- Any human activity has a learning process. MFIs should be getting more socially efficient as time goes on.
- But it could be that age means taking things for granted and that organisations become less productive.

- No significant relationship was found between age and efficiency. This was found between age and size (0.382).
- MFIs do not become wiser with age, they just get fatter.

<table>
<thead>
<tr>
<th>Age</th>
<th>Social Efficiency</th>
<th>Size</th>
<th>Transparency</th>
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<tbody>
<tr>
<td>0.120</td>
<td>0.284 **</td>
<td>0.478</td>
<td>0.265</td>
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Transparency and social efficiency

- The issue has been extensively studied in accounting.
- The best organisations are presumed not to be afraid of disclosing information. Efficient MFIs should be eager to give a full account of their activities to donors. The most efficient should be the most transparent.
- Mix scores transparency by means of a diamond system.

- Association is low and not significant.
- There is significant correlation between profitability and transparency (0.264)
Social efficiency and geographic location

- We identify four groups: Asia, Africa, Latin America and East Europe.

<table>
<thead>
<tr>
<th>Region</th>
<th>Test</th>
<th>Significant</th>
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<tr>
<td>Asia</td>
<td>ANOVA</td>
<td>ACE-W**, ACE-WP**</td>
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<td></td>
<td>Mann-Whitney U</td>
<td>ACE-W**, ACE-WP**</td>
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<td>Africa</td>
<td>ANOVA</td>
<td>ACE-LR*</td>
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<td></td>
<td>Mann-Whitney U</td>
<td>(ACE-L*) (ACE-R*)</td>
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<td>ANOVA</td>
<td>ACE-L*, ACE-R**, ACE-LR*</td>
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<td>Mann-Whitney U</td>
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<tr>
<td>East Europe</td>
<td>ANOVA</td>
<td>ROA*, ACE-L*, ACE-R**, (ACE-P*)</td>
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</table>

- Asian MFIs have high social efficiency. African MFIs have low financial efficiency. Latin American MFIs have high financial efficiency. East European MFIs have low social efficiency and high financial efficiency.

Conclusions

- The performance of MFIs needs to be assessed both from the financial and from the social point of view (double bottom line).
- A DEA model has been developed to measure performance in both aspects. We have worked with financial and social outputs.

- We found a low but positive relationship between social efficiency and financial efficiency. MFIs clearly form 4 groups from this point of view.
- We found positive and significant correlation between two definitions of social efficiency (fight against poverty, supporting women).
- NGO MFIs appear to be more socially efficient than MFIs operating under other organisational structures.
- No relationship was found between social efficiency and other variables such as profitability, age, or transparency in accounting information.
- Geographical location is important, as known by the first study.


Work is continuing....