

# Can Risk-Based Pricing Improve Social and Financial Efficiency of Microfinance Institutions, its Impact on Financial Inclusion and Access to Traditional Banking Services?

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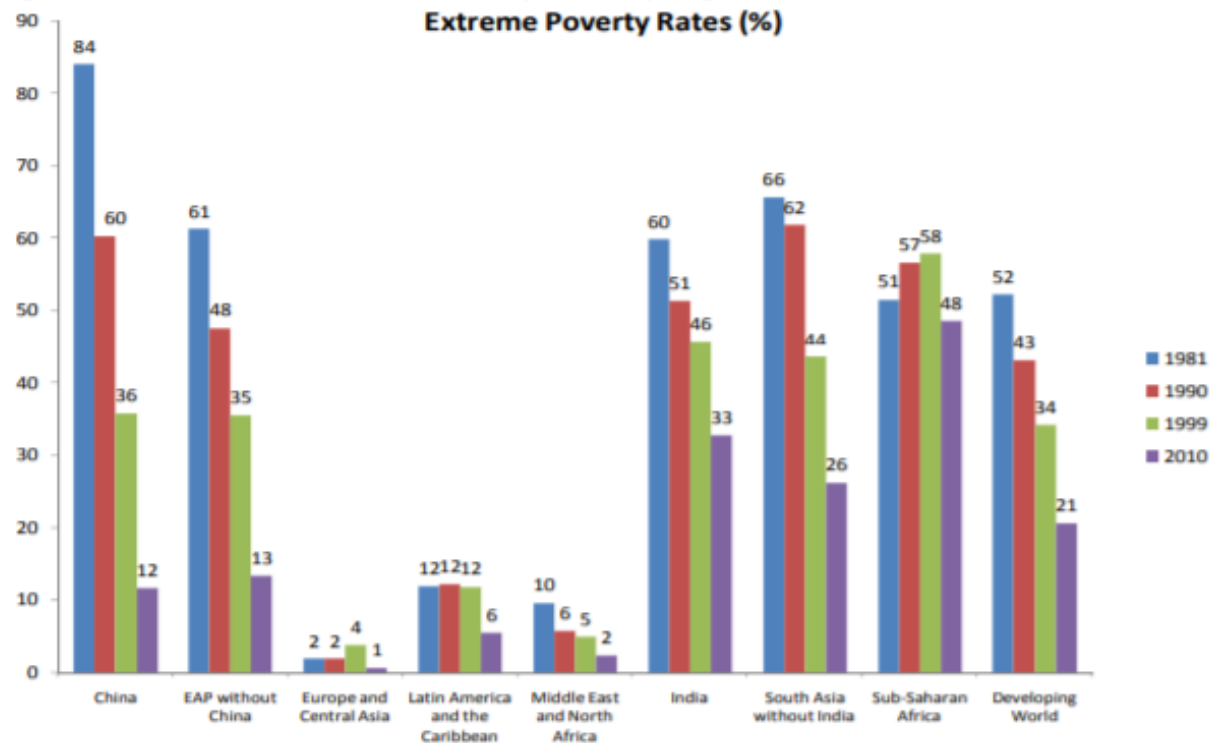
# History of Microfinance

Designed as the solution to global poverty, microfinance concept was introduced in the 1970s. Microloans by the “Village Bank” were granted with zero interest rate. However, with ever-increasing demand the industry soon realized that it would not be able to grow sufficiently by only relying on grant funding.

## Double-bottom objective line

- 1 **Social objective** – outreach
- 2 **Financial objective** – sustainability

Fig 1: The Evolution of Extreme Poverty Rates by Region



Source: World Bank staff estimates.

# The Study Questions

01

What is the financial and social efficiency of Microfinance institutions across developing countries of the Sub-Saharan African region?

02

How environmental components such as regulation, credit bureaus and international funding effect efficiency?

03

Does the microfinance industry contribute to the improvement of consumer access to traditional banking services?

04

What is the role of risk management in the MFI efficiency?

# Content

- Study of social and financial efficiency
- Achievable targets
- Impact of environmental components
- Risk based pricing
- Financial inclusion – empirical evidence

# Data Envelopment Analysis

## Our methodology:

$N$  number of operating units (DMUs)  $j = 1, 2, \dots, N$

$n$  number of inputs  $i = 1, 2, \dots, n$

$m$  number of outputs  $r = 1, 2, \dots, m$

$y^{rj}$  observed level of output  $r$  from DMU  $j$

$x^{ij}$  observed level of input  $i$  from DMU  $j$

$v_i$  weight on input  $i$

$u_r$  weight on output  $r$

$E_j$  efficiency of DMU (0-100%)

$$E_j = \frac{\sum_{r=1}^m u_r y^{rj}}{\sum_{i=1}^n v_i x^{ij}}$$

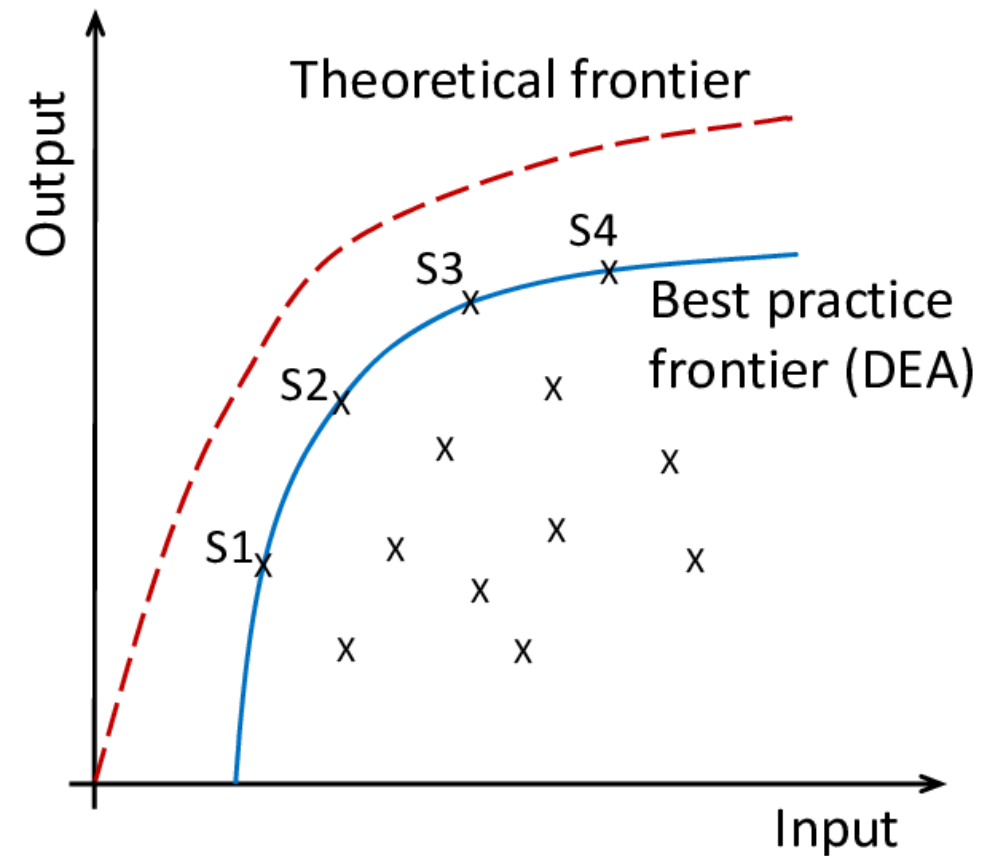


Figure 2. Data Envelopment Analysis -Production Frontier

# Hyperbolic non-oriented DEA model

$$\begin{aligned}
 & \min \theta \\
 \text{s.t. } & \sum_{j=1}^N \lambda_j x^{ij} \leq \theta x^{it}, i = 1, 2, \dots, n; \\
 & \sum_{j=1}^N \lambda_j y^{rj} \geq \phi y^{rt}, r = 1, 2, \dots, m; \\
 & \sum_{j=1}^N \lambda_j = 1, j = 1, 2, \dots, N; \\
 & \lambda_j \geq 0; \\
 & \phi = 2 - \theta; \\
 & \theta, \phi \geq 0
 \end{aligned}$$

$x_{ij}$  and  $y_{rj}$  are the  $i$ th input and  $r$ th output of the  $j$ th DMU,

$\theta$  is the input - minimizing efficiency for the DMU under investigation,

$\phi$  is output maximizing efficiency of the DMU under investigation,

constraint  $\phi = 2 - \theta$  is the first - order linear approximation of the constraint  $\theta * \phi = 1$ ,

convexity constraint  $\sum_{j=1}^N \lambda_j = 1$  represents variable returns to scale assumption.

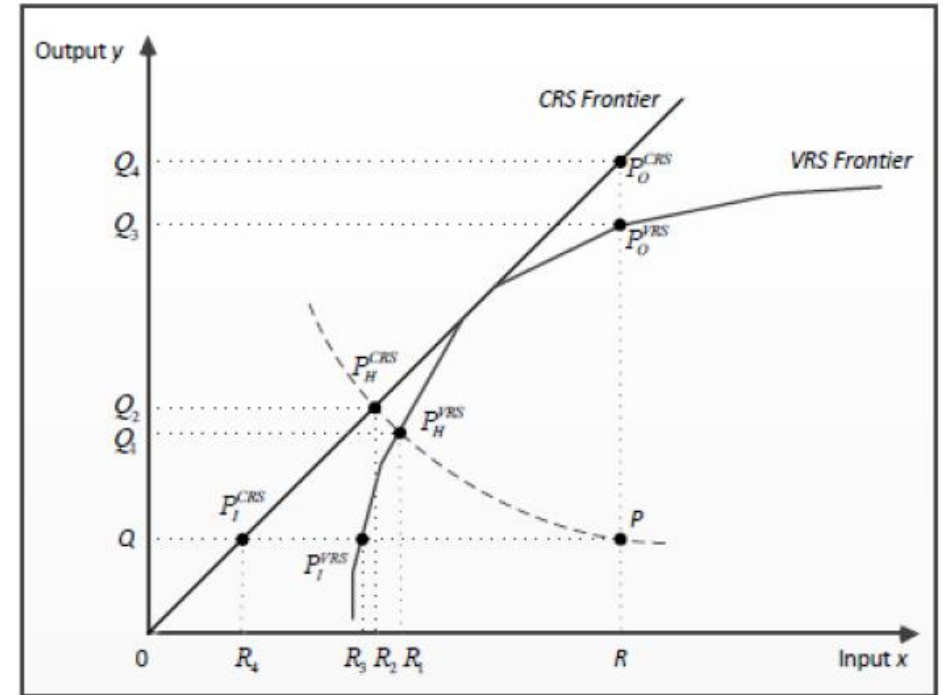


Figure 3. Non-oriented hyperbolic DEA model

# Model composition

Efficiency Specification	Input Variables	Output variables
Overall efficiency	Assets (A), Operating expenses (O), Portfolio at risk 30 days (R), Employees (E)	Financial revenue (F), Average loan balance per Borrower (in Inverse form) (I), Number of borrowers (B)
Financial efficiency	Assets (A), Operating expenses (O), Portfolio at risk 30 days (R), Employees (E)	Financial revenue (F)
Social efficiency	Assets (A), Operating expenses (O), Portfolio at risk 30 days (R), Employees (E)	Average loan balance per Borrower (in Inverse form) (I), Number of borrowers (B)

Table 1. DEA model composition for social, financial and overall efficiency

# Model robustness

- **Input oriented model** - model standardizes input-output sets to the common output value and only utilization of inputs is further investigated in the model
- **Output oriented model** - standardized input level is used and efficiency is then estimated based on output production.
- **Non-oriented model** - model enables output expansion and input reduction at the same time and offers more flexibility for decision-making units when selecting input-output combination.

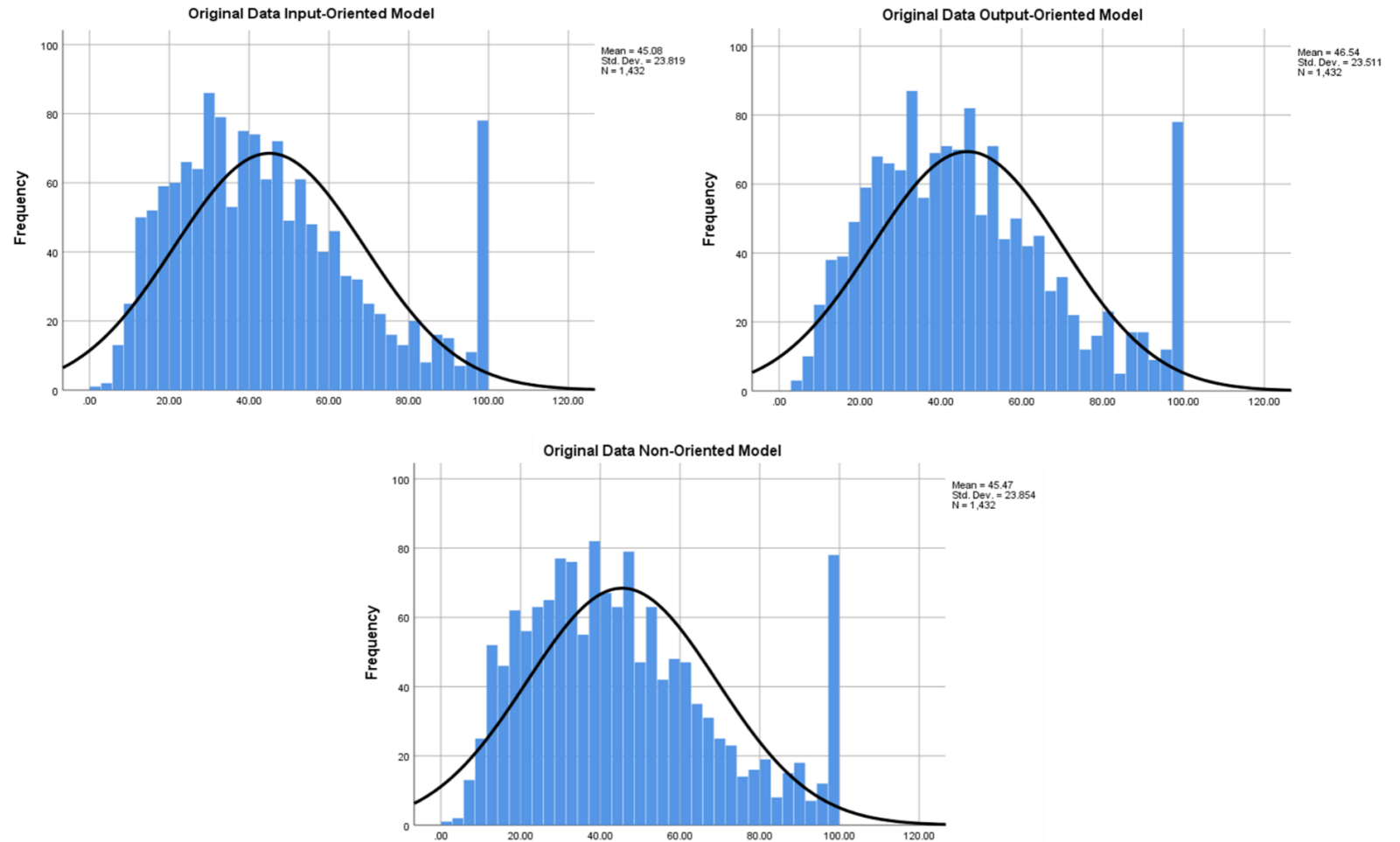


Figure 4. Efficiency distributions under input-, output- and non-oriented approaches

# Model results



Figure 5. Country-level aggregated social and financial efficiency levels for period 2004-2011

# Model results – continuing

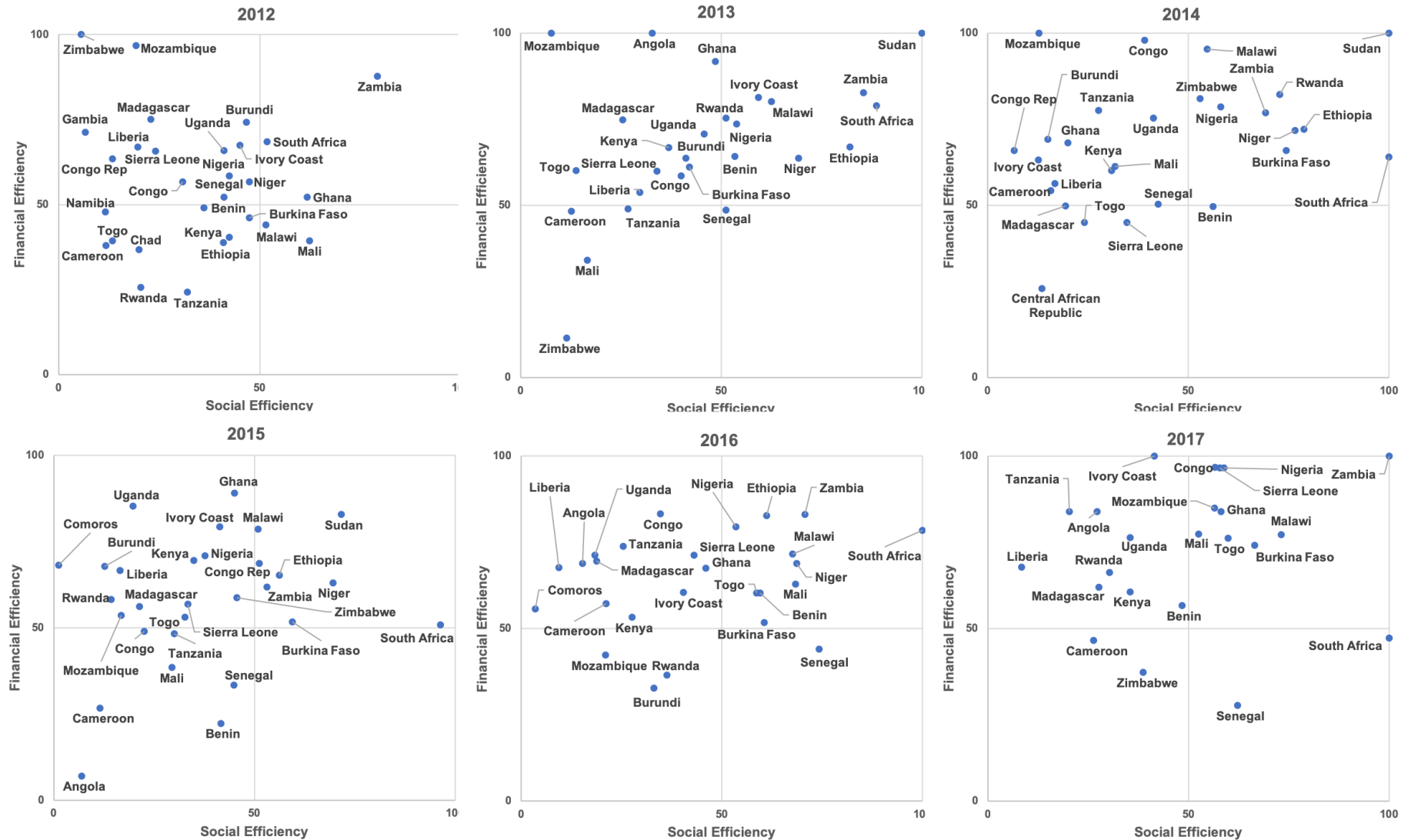


Figure 6. Country-level aggregated social and financial efficiency levels for period 2012-2017

# Model results – macroeconomic factors

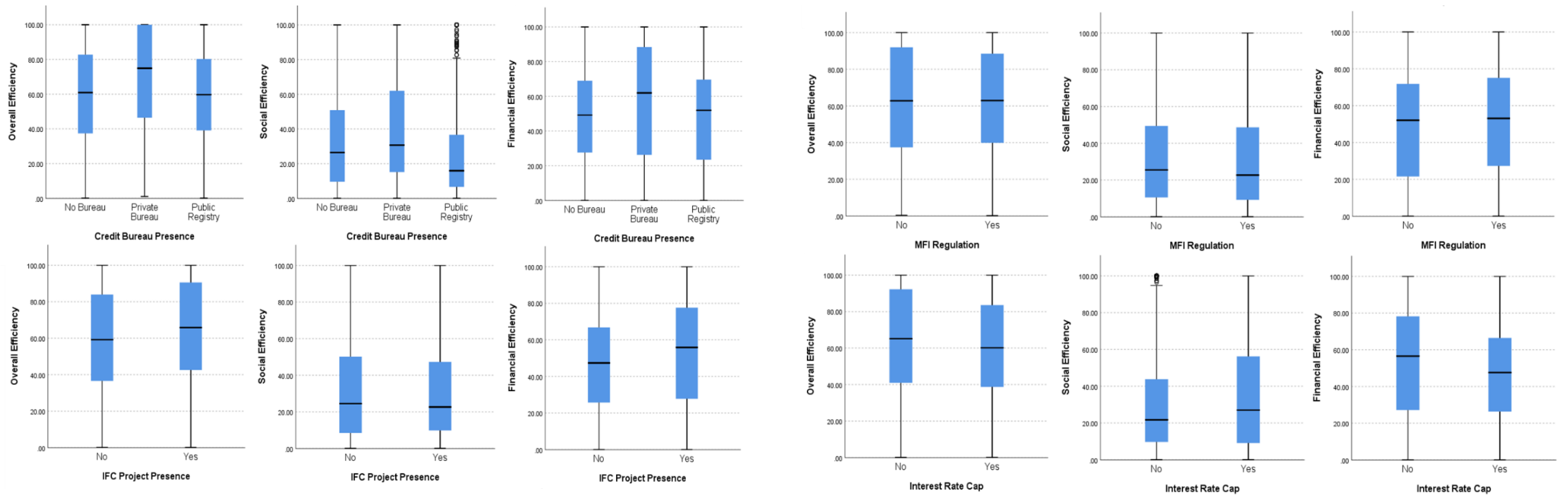


Figure 7. Mean Values of Meta-Frontier efficiency level's by categorized groups - economy level factors

# Efficiency targets

A

Portfolio served by microfinance institutions could have been larger by 25-26% if microfinances were operating closer to efficiency frontier.

B

When applying the ratio to the indicators provided in the Microfinance Barometer (123 million consumers overall), it is fair to conclude, the number of MFI consumers can be increased by 30 million without the addition of extra input resources.

	Actual overall eff	Target overall eff	Actual/Target, %	Potential Gain, %	Actual social eff	Target social eff	Actual/Target, %	Potential Gain, %
2004	2506165	3640848	69%	31%	2506165	3270403	77%	23%
2005	3297066	3939638	84%	16%	3297066	4229839	78%	22%
2006	3995952	4685304	85%	15%	3995952	5244671	76%	24%
2007	4714860	5565145	85%	15%	4714860	5763919	82%	18%
2008	5151580	6308727	82%	18%	5151580	6339798	81%	19%
2009	5671260	7773261	73%	27%	5671260	6994317	81%	19%
2010	4405388	4940596	89%	11%	4405388	5438120	81%	19%
2011	4740522	5495065	86%	14%	4740522	6041225	78%	22%
2012	3861725	4441327	87%	13%	3861725	4899834	79%	21%
2013	3900624	4377141	89%	11%	3900624	5086480	77%	23%
2014	4685761	5548520	84%	16%	4685761	5943340	79%	21%
2015	4639549	6306162	74%	26%	4639549	6211804	75%	25%
2016	4980591	6000687	83%	17%	4980591	6405046	78%	22%
2017	4184783	4642436	90%	10%	4184783	5380251	78%	22%

Table 2. Achievable targets of outreach – number of consumers

# Risk based pricing and financial inclusion

Expected profit maximization

$$\text{Max}_r E[P_A(r)] = [q(r)((r - r_f)p - (LGD + r_f)(1 - p))], \text{ High}$$

where

$r$  – interest rate,

$p$  – probability of being good,

$q(r)$  – probability of accepting the loan,

$r_f$  – opportunity cost,

LGD – loss given default.

Population willing to pay  $r_1$  or more

$$\int_{r_1}^{\infty} w(r) dr = q(r_1)$$

logistic price–response function is assumed

$$w(r) = \frac{ba^{a-br}}{(1 + e^{a-br})^2}$$

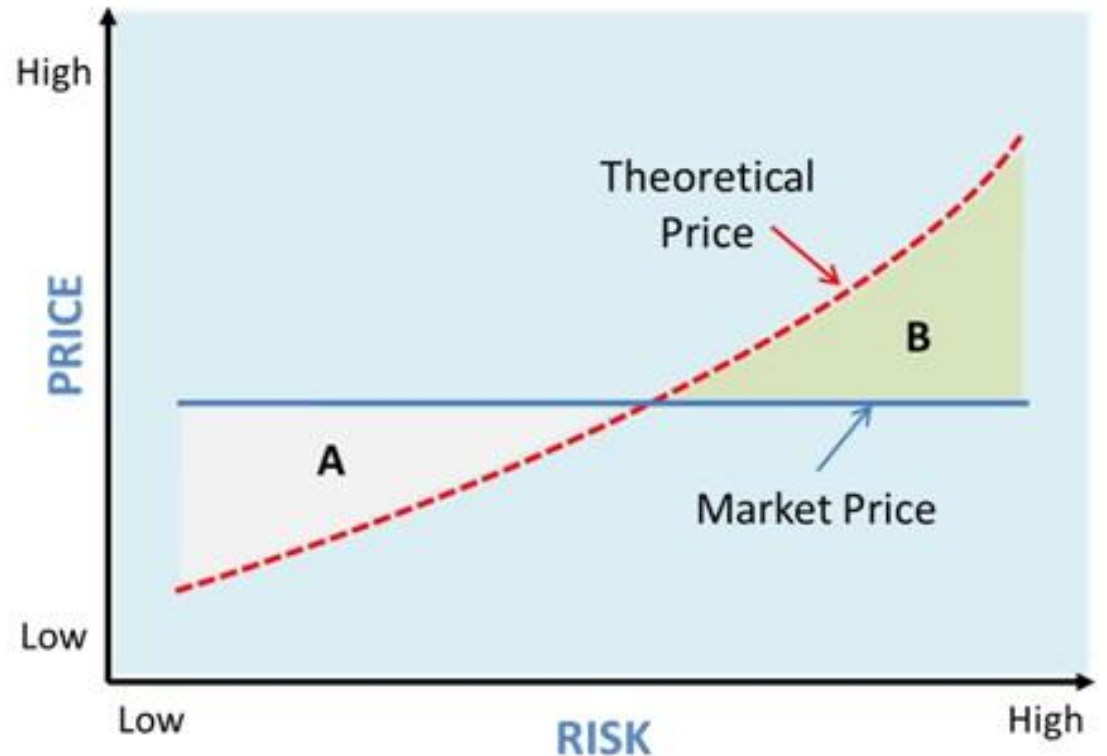


Figure 8. Concept of risk based pricing

# Common concerns

## First

Skewed distribution towards segment A over B and therefore inability of over-priced loans to compensate for under-priced loans;

## Second

Imperfect information and adverse selection: presence of asymmetric information between the buyer and the seller of a contract and as result, underestimated credit risk;

## Third

Affordability: interest rate charged on the loan affects the borrower's affordability to pay back the loan and therefore on the bad rate.

# Empirical evidence

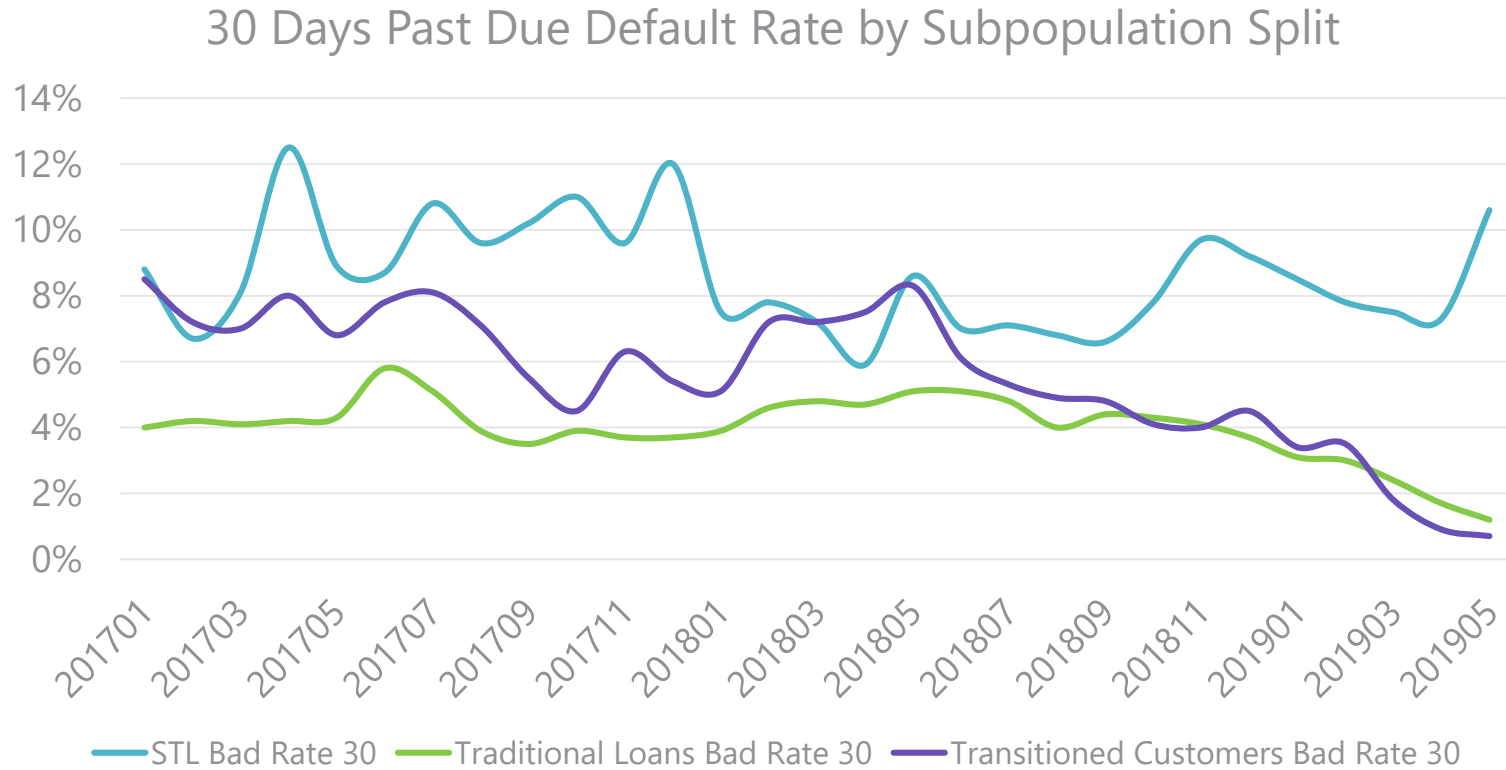


Figure 9. 30 Days Past Due Default Rate by Subpopulation Split

In average\*, consumer receives loan, which is 110.7 time higher then the max loan amount in his/her previous credit history;

\* after excluding extreme deviations

From all consumers who historically have had, 84% of consumers, who had have delinquency on short term loans no delinquency once transitioned to the traditional banking.

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