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RESUMEN

Este estudio tiene como objetivo evaluar la eficiencia social de las instituciones microfinancieras (IMF) peruanas —reguladas y no reguladas—. La eficiencia social está referida a la capacidad de las IMF de producir más output social (cantidad de clientes pobres atendidos) sin emplear más recursos productivos. La metodología del Análisis de la Envolvente de Datos (DEA) es empleada para llevar acabo el análisis de eficiencia. Adicionalmente, se analizan los potenciales determinantes de la eficiencia social de las IMF a través de un análisis de regresión Tobit en el contexto de datos de panel, a fin de indagar si las diferencias relacionadas a la naturaleza institucional de los operadores microfinancieros explican las diferencias en la eficiencia social alcanzada por ellos. El periodo de estudio cubre los años del 2007 al 2011. Los resultados muestran que las IMF no reguladas conforman en su mayoría el segmento de instituciones socialmente más eficientes. Por el contrario, aquellas IMF que se encuentran dentro del esquema regulatorio muestran, en la mayoría de los casos, posiciones lejanas a la frontera de eficiencia. Del análisis de regresión se desprende que el ser una IMF regulada afecta negativa y significativamente los niveles de eficiencia social mientras una mayor presencia en el medio rural afectaría positivamente los niveles de eficiencia social. Aun cuando, existe evidencia de que la rentabilidad financiera podría relacionarse positivamente con la eficiencia social; este resultado no parecería ser tan robusto y exigiría una investigación adicional centrada específicamente en el tema. En el otro extremo, la tecnología crediticia parecería no ser relevante para explicar la eficiencia social de las IMF.

Código JEL: G21, O10, O16

Palabras clave: Microfinanzas, eficiencia social, fronteras de la eficiencia, análisis de la envolvente de datos.

ABSTRACT

This study aims to assess the social efficiency of microfinance institutions (MFIs) —regulated and non-regulated— in Peru. Social efficiency is referred to the capacity of MFIs to produce more social outputs —number of poor clients and women served— without using more resources. The Data Envelopment Analysis methodology is used to carry on efficiency analysis. Additionally, we analyze the potential determinants of social efficiency of MFIs through a Tobit regression analysis in the context of panel data, in order to investigate whether differences related to the institutional nature of MFIs explain differences in social efficiency achieved by them. The study period covers the years from 2007 to 2011. The results show that non-regulated MFIs are socially more efficient. On the contrary, those MFIs which are within regulatory scheme, shown in most cases, distant positions to the efficient frontier. Regression analysis shows that being a regulated MFI negatively affects social efficiency levels, a greater presence in rural area positively affect social efficiency levels. Although there is evidence that financial returns could relate positively to social efficiency, this result does not seem to be as robust. At the other extreme, the lending technology does not seem to be relevant to explain social efficiency.

JEL Code: G21, O10, O16

Key word: Microfinance, Social Efficiency, Efficiency frontiers, DEA analysis.

SOCIAL EFFICIENCY IN PERUVIAN MICROFINANCE INSTITUTIONS: A SEMI-PARAMETRIC APPROACH[1]

Giovanna Aguilar[2] y Jhonatan Clausen[3]

1. INTRODUCTION

Financial inclusion is defined as the incorporation of excluded segments of the population —in general, population in poverty situation— into the financial market through the supply of financial services and/or products, which feature adequate conditions of location, availability, costs, among other considerations. In this task, microfinance institutions (MFIs) can play an important role as they have, in principle, a dual orientation which has earned them a place among the so-called Double Bottom Line institutions (DBL) (CGAP, 2004). On the one hand, they aim for financial stability, and on the other, for the objective of serving poor segments of the population, un-attended by commercial banks. Nevertheless, in the Peruvian microfinance industry, there are MFIs of diverse institutional nature, size, funding sources, among other aspects, which begs the question of whether they can be effectively considered as DBL institutions and are thus able to accomplish the social objective of reaching the poorest segments of the population. To answer this question, an assessment of the achievement of their social objective is required.

The provision of services to the poorest population, also called the scope or reach of an MFI, can be assessed by the number of people served, the average loan amount, the value and cost of services for the clients, among other indicators. However, other ways to approach the evaluation of the social performance of MFIs involve analyzing the efficiency with which they operate

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in order to produce social outputs, defined as the size of the population in poverty that is provided with financial services. That is, to analyze the institutions' ability to make an optimal use of their production resources (inputs) in order to provide for the largest possible number of poor clients – social efficiency.

This study aims to assess the social efficiency of Peruvian MFIs, both regulated and non-regulated. To this end, we apply Data Envelopment Analysis (DEA) methodology which allows us to evaluate the extent to which MFIs can generate more social output without requiring additional resources and, consequently, to rank the institutions according to their levels of social efficiency. Additionally, the potential determinants of MFI social efficiency are analyzed with a panel data model, in order to establish whether differences related to the institutional nature of the microfinance operators can explain the differences in social efficiency. The analyzed period covers the years between 2007 and 2011.

The diagnosis of social efficiency and of its determinant factors provides valuable insights that enable us to identify those operators with the highest potential to act in many of the private and public initiatives that promote financial inclusion. This, in its turn, facilitates the attainment of optimal results and/or to improve upon those that are being obtained, in terms of broadening access of the poor to financial services.

This paper has six sections besides this introduction. In the second section, we present the conceptual framework of the study; the third section features some stylized facts with regard to indicators of reach, specifically in terms of social production of the analyzed MFIs. The fourth section presents a brief description of the methodologies used in the social efficiency analyses and their determinants. In the fifth section the results of the estimations are provided and finally, the sixth section concludes.

2. CONCEPTUAL FRAMEWORK

Microfinance institutions (MFI) are organizations that provide financial services to those segments of society that aren't ordinarily served by commercial banks. Specifically, they deal with low-income segments like micro- and small enterprises (SME) and low-income households. In the mid-90s of last century, Yaron (1994) stressed —in his analysis of rural financing— that MFIs have two main objectives: financial sustainability and social reach. Usually, social reach is approximated by the gender and poverty situation of an MFI's borrowers (Navajas et al., 2000). Financial sustainability, in turn, refers to the continuity or survival of an institution within its relevant market. An adequate assessment of MFI performance should therefore take into account both aspects.

One way of assessing the performance of MFIs relies on the degree of efficiency with which they achieve their goals. According to the theoretical framework proposed by Farrell (1957), efficiency can be: productive (or technical), allocative (also called price efficiency), and global (a combination of the first two). The concept of productive efficiency reflects the ability of a decision making unit (DMU) to maximize production with a given quantity of inputs. Allocative efficiency is an indicator of "the ability of the unit in employing different inputs in their optimal proportions, given relative prices" (Coll and Blasco: 2006, p.4). Finally, a DMU is globally efficient to the extent that it is both technically and allocatively efficient.

Additionally, Farrell (1957) did also propose a specific measure for evaluating technical and/or allocative efficiency starting from a standard benchmark, considered the efficient frontier, which should incorporate the best practice or practices found in a sample of analyzed DMUs. The results of all other units are compared against this benchmark in order to find their respective levels of efficiency.

Social efficiency concept proposed by Gutiérrez-Nieto et al. (2009), for the assessment of the social performance of a worldwide group of MFIs, is based on the concept of technical efficiency of Farrell (1957), with the particularity that the former evaluates a set of "social outputs". Thus, an MFI is considered

socially efficient to the extent that it generates more social outputs without consuming more resources (Mar, 2009).

There are many methods for the estimation of efficiency levels in firms. Coll and Blasco (2006) divide these in two large groups: parametrical and non-parametrical. The first group includes the Stochastic Frontier Approach (SFA), the Thick Frontier Approach (TFA) and the Distribution Free Approach (DFA). The second group contains the Data Envelopment Analysis (DEA) method, which belongs to the group of mathematical-deterministic programming techniques. These methods have been used in several studies for assessing financial efficiency of both banking institutions and MFIs[4]. However, the analysis of social efficiency has gathered less attention as evidenced by the reduced number of studies in this field. In this respect, the pioneering work of Gutiérrez-Nieto et al. (2009) for a group of MFIs on a worldwide basis is worth mentioning.

The analysis of social efficiency requires the definition of both inputs and outputs in the financial intermediation activity. Regarding this issue, there are two approaches in the literature: the production approach (Benston, 1965; Bell and Murphy, 1968) and the intermediation approach (Benston, Hanweck and Murphy; 1982). According to the first approach, financial intermediaries produce deposit and loan services represented by the number of depositors and borrowers —using capital and labor as inputs. Under this point of view, the products are measured as the number of supplied products or services[5]. According to the intermediation approach, the product of financial intermediation is the supply of loans, and the inputs are labor, capital and loanable funds. Under this point of view, output is measured by the monetary value of loans. Given the interest in assessing social efficiency defined as social production —represented by number of clients in situation of poverty and number of women borrowers— it is more convenient to consider the

[4] Regarding this, Berger and Humphrey (1997) reference 130 studies on the efficiency of the financial system in 21 countries, which employed both parametric and non-parametric techniques. In the same vein, a recent example of the application of these methodology is found in Hermes et al. (2001), which analyzes the link between financial efficiency and social reach objectives for a sample of MFIs by the method of stochastic frontiers.

[5] Number of deposits or number of loans, or the sum of both.

production approach as in Gutiérrez-Nieto et al. (2009). On the other hand, the emphasis of many MFIs in the provision of loans rather than the collection of deposits, especially when many of them operate with donated funds —more so in the case of NGOs—, makes the production approach of Gutiérrez-Nieto et al. (2009) more appropriate. Thus, two measures of social output can be defined: i) the number of poor clients served by an institution, and ii) the number of female clients in each institution, under the assumption that this group of clients has a high incidence of poverty. Moreover, the following inputs are taken into account in order to obtain the social outputs: financial assets, operating costs and the number of employees.

The results arrived at by Gutiérrez-Nieto et al. (2009) are obtained under the assumption of constant returns on scale. However, this assumption may be inadequate for the Peruvian case due to the high degree of heterogeneity among MFIs. In consequence, our analysis incorporates the existence of different types of returns on scale in order to take into account such heterogeneity.

Regarding the factors that determine the degree of social efficiency of the MFIs, the literature reveals that unregulated MFIs tend to be more efficient in social terms than regulated ones (Gutiérrez-Nieto et al., 2009). This result can be attributed to the fact that operating within a regulated framework requires MFIs to prioritize sustainability before other social objectives. Another element that could play a role in determining the levels of social efficiency is the MFI's geographical localization. The underlying idea is that MFIs located in rural areas —with a higher concentration of poor population— have a relative advantage in reaching the poor segments of the population with respect to the MFIs located in urban areas, where poverty levels are generally lower. The type of credit technology employed by the MFIs can also be considered as a determinant of social efficiency. MFIs that provide services to the poor population through technologies based on communal banks or solidarity groups rather than individual loans, could be including a larger share of the population by the reduction of credit risk arising from these mechanisms of collective responsibility. Finally, the profitability of an institution can be a financial determinant of social efficiency. In this case, its

impact on social efficiency would be negative to the extent that those MFIs that aim for higher levels of profitability could be doing so at the expense of targeting the more profitable, and thus less poor, population (Yaron, 1994).

The hypothesis arising from this framework is that unregulated MFIs, given their institutional features, location, financial technology and profitability levels, show higher levels of social efficiency than regulated MFIs in the 2007-2011 period.

3. STYLIZED FACTS

3.1 Analyzed MFIs

The MFIs subject to the present analysis can be classified in two main categories: regulated and non-regulated. The former are in the group of financial intermediaries that are subject to regulation and supervision by the Superintendent of Banking, Insurance and Private Management of Pensions Funds (Superintendencia de Banca, Seguros y Administradoras de Fondos de Pensiones - SBS). This group of microfinance intermediaries includes Municipal Banks (Cajas Municipales de Ahorro y Crédito - CMAC), Rural Banks (Cajas Rurales de Ahorro y Crédito - CRAC), Small and Micro Enterprises Development Institutions (Entidades de Desarrollo de la Pequeña y Microempresa - EDPYME) and the Banks and Financial Companies that are specialized in microfinance[6]. The group of non-regulated MFIs includes several Non Governmental Organizations (NGOs) with microcredit programs. Given the un-regulated and un-supervised nature of these MFIs, there isn't an official registry of them, so there is no way to know with any certainty the total number of the institutions or their total loan volume. However, some of them (arguably the most important and active) are associated to the Consortium of Private Organizations of Small and Micro Businesses

[6] It is possible to include as a part of this group some Savings and Credit Cooperatives (Cooperativas de Ahorro y Crédito - COOPAC) that are not directly supervised and regulated by SBS, but they are supervised by the National Federation of Savings and Credit Cooperatives of Peru (FENACREP). However, they are not included in this analysis because they constitute a very small share of total loans and number of clients in the regulated segment of MFIs.

Development Promotion (Consorcio de Organizaciones Privadas de Promoción al Desarrollo de la Pequeña y Microempresa - COPEME). This entity promotes policies for the strengthening of its associates' capabilities and provides statistical information on their activities.

All regulated MFIs are deposit-funded with the exception of EDPYME, which aren't authorized to collect deposits and must rely on both domestic and foreign credit lines, as well as donations. Another key feature of regulated MFIs is that their credit products are mainly individual loans.

Non-regulated MFIs do not collect deposits, and thus their main sources of funding are donations and credit lines from international cooperation agencies, which in many cases charge subsidized interest rates. The credit products of these MFIs are in some instances based on group schemes of financing (solidarity groups and communal banks).

Regulated MFIs need to generate profits in order to remain active in the market and to comply with regulatory and supervisory requirements, whereas non-regulated MFIs are non-profit organizations. The latter may constitute an advantage for non-regulated institutions in terms of social mission criteria, but it could also be a weakness because it leads to higher vulnerability to resource scarcity in crisis situations (Garcés, 2009).

Table 1 lists both regulated and non-regulated MFIs that were included in the present analysis, on the basis of information provided by SBS and COPEME.

Table 1
Peruvian Microfinance Institutions

Regulated	Non Regulated (NGO)
CMAC Arequipa	NGO Adra Perú
CMAC Cusco	NGO Alternativa
CMAC Del Santa	NGO AMA
CMAC Huancayo	NGO ARARIWA
CMAC Ica	NGO ASIDME
CMAC Maynas	NGO Edaprospo
CMAC Paita	NGO Finca Perú
CMAC Pisco	NGO Fondesurco
CMAC Piura	NGO Fovida
CMAC Sullana	NGO IDER César Vallejo
CMAC Tacna	NGO Idesi Lambayeque
CMAC Trujillo	NGO Idespa
CRAC Cajamarca	NGO Manuela Ramos
CRAC Cajasur	NGO Microcrédito S.A.
CRAC Chavín	NGO Mide
CRAC Credinka	NGO Prisma
CRAC Inkasur	NGO Promujer Perú
CRAC Libertadores Ayacucho	NGO Cáritas del Perú
CRAC Los Andes	NGO Adea Andahuaylas
CRAC Nor Perú	NGO GCOD
CRAC Nuestra Gente	NGO Idesi Grau
CRAC Profinanzas	NGO Mentors
CRAC Prymera	
CRAC San Martín	
CRAC Señor de Luren	
CRAC Sipán	
EDPYME Alternativa	
EDPYME Crear Tacna	
EDPYME Credivision	
EDPYME Nueva Vision	
EDPYME Pronegocios	
EDPYME Proempresa	
EDPYME Raíz	
EDPYME Solidaridad	
Crediscotia	
Financiera Confianza	
Financiera Crear	
Financiera Edyficar	
Mibanco	

Source: COPEME, SBS

According to information by SBS, as of December 2011 there were 12 CMAC, 11 CRAC, 8 EDPYME, 4 finance companies and one Bank (Mibanco) specialized in microfinance. Regarding non-regulated MFIs, COPEME reports information on 22 NGOs with an important degree of specialization in microfinance.

As of December 2011, the group of MFIs included in Table 1 held a loan portfolio of approximately 20,000 million of Peruvian nuevos soles (PEN) (see Table 2). Regulated MFIs accounted for 98.6% of this portfolio and non-regulated MFIs held the remaining 1.4%.

Table 2
Total loan portfolio
(Thousands of Peruvian nuevos soles of 2009)

Year	Total	Regulated	Non-regulated
2007	8,767,213	8,606,125	161,088
		98.2%	1.8%
2008	11,078,259	10,915,870	162,390
		98.5%	1.5%
2009	14,023,075	13,825,277	197,798
		98.6%	1.4%
2010	16,832,469	16,611,926	220,543
		98.7%	1.3%
2011	19,390,212	19,121,571	268,640
		98.6%	1.4%

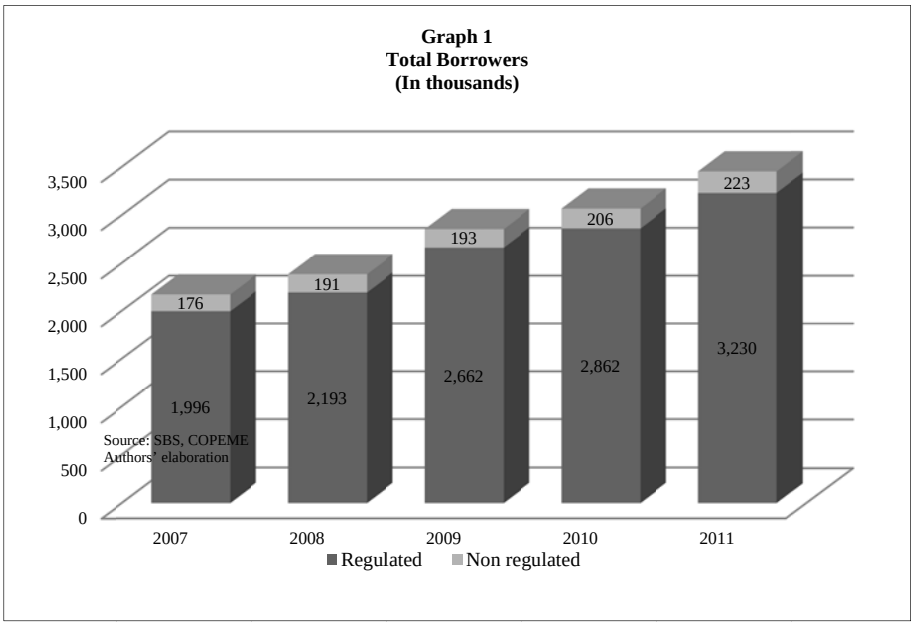
Source: SBS, COPEME
Authors' elaboration

Despite the fact that the loan portfolio of regulated MFIs is significantly larger than that of their non-regulated counterparts, both groups have shown similar rates of growth. This shows that both types of institution have played a role in the expansion of the microfinance sector in Peru.

3.2 Some data on social performance

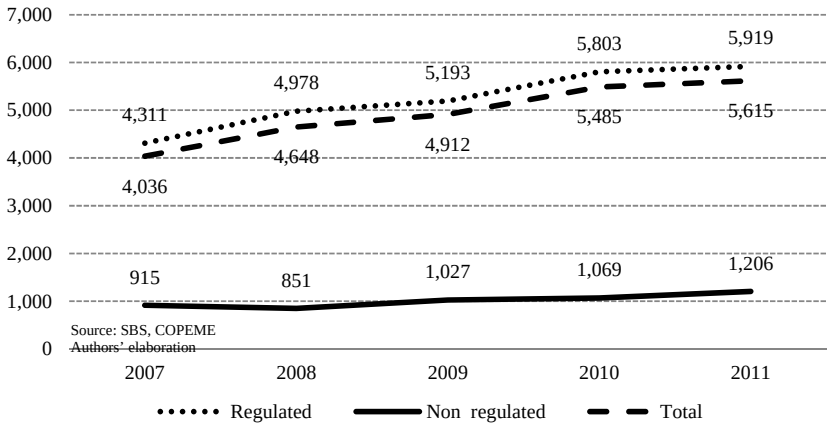
Regardless of the significant volume in loans achieved by Peruvian MFIs in the 2007-2011 period, it is important to evaluate the social reach attained in terms of served clients by theses financial intermediaries. The total of MFI clients analyzed in the present studied surpassed 3 million in 2011 (See Graph 1). This evolution reflects the extent to which the expansion of the

financial industry has increased access to credit for lower-resource segments, mostly in loans to finance small businesses and productive units.



A first approximation to the depth of social reach achieved by MFIs relies on the value of average loans, under the assumption that MFIs with lower average volume are those that access (and serve) a wider segment of the poor population.

Graph 2
Average loan per borrower
(Peruvian nuevos soles of 2009)

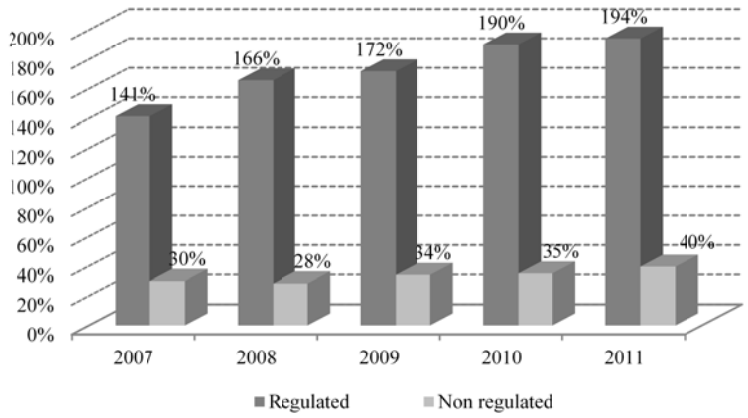


Source: SBS, COPEME
Authors' elaboration

Graph 2 shows the evolution of average loans in 2007-2011 by type of MFI (regulated and non-regulated). Even if the average loan of both types of MFIs shows an upward trend, the difference in the average loans between them is significant. In fact, the average amount lent by regulated MFIs was almost five times the average lent by non-regulated MFIs in 2011. This difference may indicate that those clients served by regulated MFIs belong to a higher income segment than the clients of non-regulated MFIs.

Another way of observing the evolution of social reach is to examine the average loan as a percentage of the annual poverty line. If MFIs are serving the population in poverty, one may expect that this percentage is low (considering that this population lack any type of collateral that could mitigate default risk). Graph 3 shows that such proportion is much higher in the case of average amounts lent by regulated MFIs. In effect, whereas regulated MFIs lend amounts that can almost match 200% of the poverty line, non-regulated MFIs lend average loans that are 40% of the poverty line at best.

Graph 3
Average loan as a percentage of the annual poverty line



Source: SBS, COPEME
Authors' elaboration

These numbers seem to indicate that the clients of regulated MFIs are not poor in most cases, and that these institutions could be straying from their social mission.

4. METHODOLOGY AND STATISTICAL INFORMATION

The DEA methodology is a non-parametric method for estimating efficiency, and was proposed by Charnes, Cooper and Rhodes (1978) for calculating the productive (or technical) efficiency of a Decision Making Unit (DMU). The DEA method employs linear programming for the estimation of an efficiency frontier, on the basis of which all units are re-scaled: from the most efficient ones (which lie on the efficiency frontier) to the most inefficient (which lie farther from the frontier).

Given the heterogeneity in size of the MFIs included in the analysis, the application of the DEA method assumes that there are variable returns on scale (increasing and decreasing). This variant of the methodology is also known as DEA-BCC, and was developed by Banker, Charnes and Cooper (1989).

When returns on scale are not constant, it is necessary to take into consideration two perspectives regarding productive efficiency: i) output-

oriented and ii) input-oriented. The former refers to the ability of the firm to increase its outputs in a proportional manner, given a fixed quantity of inputs. If the company were able to increase output in these conditions, it would not be efficient, since it is not operating at the production possibilities frontier. The latter perspective refers to the ability of the productive unit to reduce its inputs in a proportional way, and at the same time keeping the output level fixed. Again, if this were the case, the firm would not be operating in an efficient way (Charnes, Cooper and Rhodes, 1981[7]).

In line with Ramanathan (2003), we adopt the input-oriented perspective in the present study, since it is more convenient for the cases when the outputs are determined by the firm's management, rather than by other conditions. In fact, this seems to be the case of many MFIs that pursue social goals, that is, increasing access to the poor population.

We assume the existence of N DMUs, each of which produces M kinds of outputs by utilizing K types of inputs. The measure of (relative) technical or productive efficiency for the i-th DMU is given by the following expression:

$$w_i = \mu' y_i + b_i$$

Where: w_i: indicator of relative efficiency for the i-th DMU, w_i: output vector produced by the i-th DMU, μ: vector of weights for the output, b_i: constant that indicates the type of returns to scale of the i-th DMU.

The optimization problem in the DEA-BCC framework is the following:

$$Max_{\mu,\delta,b}\, w_i = \mu' y_i + b_i$$

$$s.a.$$

$$\delta'\, x_i = 1$$

$$\mu' y_j + b_j - \delta' x_j \leq 0, \quad j = 1, \dots, N$$

$$\mu, \delta \geq 0$$

[7] When there are constant returns on scale, both measures of productive efficiency (output-oriented and input-oriented) are equal.

Where, x_i: input vector used by the i-th DMU, δ: vector of weights for the inputs.

The solution to the problem must provide μ and δ values that maximize (w_i), subject to the condition that none of the analyzed units achieves an efficiency indicator higher than 1 by using those weights (μ and δ), and that the weighted sum of inputs for the i-th DMU must equal unity. The indicators μ and δ show, in turn, the relative contribution of the corresponding outputs and inputs to the DMU's technical efficiency. b_i, in turn, is a measure of efficiency scale. A DMU is considered efficient if it has a value of $w_i = 1$ and there exists at least an optimal μ and δ. Values of $w_i < 1$, on the other hand, indicate that the DMU is inefficient. Thus, (1-w_i)*100 would indicate the percentage at which it would be possible to reduce inputs without changing the output level.

According to the production approach, inputs are defined as: total assets (I_1), operating costs (I_2), number of employees (I_3). Outputs are defined as: Number of active women borrowers (O_1) and poor borrowers access indicator (O_2).

Output O_2 has been calculated as follows. A variable K_i is defined, such that:

$$K_i = \frac{average\ loan\ per\ borrower}{per\ capita\ GDP};\ \forall i = 1, \dots, N$$

Then, on the basis of the K_i indicators, a weighting factor pi is calculated for each MFI, which is defined as follows:

$$p_i = 1 - \left\{ \frac{K_i - Min(K)}{Max(K) - Min(K)} \right\};\ \forall i = 1, \dots, N$$

Finally, we multiply p_i by a number of active borrowers in each MFI, which yields as a result the indicator O_2. The adequacy of this indicator resides in the fact that it is constructed in such a way, that if two MFIs had the same number of borrowers, the one with the lower level average loan (with respect to GDP), that is, with the lower (K_i), would have the higher value of (O_2).

Following the proposal of Gutiérrez-Nieto et al. (2009), we employ two specifications for the frontiers of social efficiency. The first takes as output the

indicator of poor clients (specification 1), whereas the second includes the number of women borrowers as well (specification 2). In both cases the 3 previously mentioned inputs are included. The efficiency frontiers were estimated for the years 2007 to 2011, and for both specifications.

The analysis of determinants of social efficiency was carried out with panel-type data, which made it necessary to calculate efficiency frontiers for each year in the 2007-2011 period (considering both specifications). An econometric model was set up, which was estimated by Tobit regression analysis in the context of panel data, given the censored nature of the efficiency coefficients that act as dependent variables (Ji and Li, 2010).

The estimated model has the form:

$$y_{it} = \gamma + \alpha_i + x'_{it}\beta + \varepsilon_{it} \qquad i = 1, \dots, N; \quad t = 1, \dots, T$$

Where y_{it} corresponds to the DEA coefficient of social efficiency for the i-th MFI in period t, α_i corresponds to the unobservable heterogeneity associated to the i-th MFI, and x_{it} is a vector of regressors of the model for the i-th MFI in period t. The explanatory variables included in this vector are: location (rural), which uses as a proxy variable the share of agricultural loans in the total portfolio; institutional nature (regulated), a dummy variable that takes the value 1 if the MFI is regulated; financial sustainability (ROE, ROA or OSS) which employs three alternative indicators: return on assets, return on equity and an operative self-sufficiency ratio; lending technology (individual), measured as the percentage of individual loans in the total loans granted by the institution and ε_{it} which is an idiosyncratic error term.

5. ANALYSIS OF RESULTS

5.1 Social efficiency frontiers

The results of the efficiency frontiers for the specifications 1 and 2 are presented now. To each of these specifications correspond two frontiers that

are built from MFI data from the years 2007 and 2011, respectively8. Table 3 shows that, for both 2007 and 2011, the higher share of MFI that compose the efficiency frontier corresponds to NGOs (non-regulated MFIs), even if two financial companies are also present (Crediscotia Financiera and Financiera Edyficar). Those MFIs that are immediately below the frontier are also mostly NGOs, whereas the number of other regulated MFIs is low (Edpyme Pronegocios and Solidaridad). For the year 2007 we observe that there are no non-regulated MFIs for efficiency levels below 0.53. A similar situation applies in 2011: most non-regulated MFIs are close to the efficient frontier, with the exception of Fondesurco which shows an efficiency level of 0.23, which means that it could reduce its inputs in 77% without changing its level of social output. On the other hand, in both frontiers the most socially inefficient institutions are the CMAC, CRAC and EDPYMEs. Thus, in 2007 the farthest position from the frontier was held by Edpyme Raíz, whereas in 2011 this position was held by CMAC Cusco.

[8] The frontiers corresponding to specification 1 include 48 MFI, whereas the frontiers of specification 2 include only 34 MFI. This is due to the lower availability of information on female borrowers.

Table 3
Social efficiency ranking, with poor clients as social output

2007		2011	
MFI	w_i	**MFI**	w_i
Crediscotia Financiera	1.00	NGO Manuela Ramos	1.00
NGO Fovida	1.00	NGO Fovida	1.00
NGO Promujer Perú	1.00	Crediscotia Financiera	1.00
NGO Alternativa	1.00	NGO ASIDME	1.00
NGO Mide	1.00	Financiera Edyficar	1.00
NGO IDER César Vallejo	1.00	NGO Promujer Perú	1.00
Financiera Edyficar	0.91	NGO Alternativa	1.00
NGO Adra Perú	0.91	NGO Finca Perú	0.93
EDPYME Solidaridad	0.88	EDPYME Pro Negocios	0.91
NGO Finca Perú	0.83	NGO Mide	0.90
NGO Manuela Ramos	0.82	NGO Adra Perú	0.85
NGO Edaprospo	0.81	NGO AMA	0.80
NGO ASIDME	0.78	NGO Edaprospo	0.79
NGO ARARIWA	0.69	NGO IDER César Vallejo	0.77
NGO AMA	0.55	NGO Prisma	0.62
CRAC Los Andes	0.54	CRAC Los Andes	0.52
NGO Fondesurco	0.53	NGO ARARIWA	0.45
EDPYME Pro Negocios	0.53	Financiera Crear	0.41
NGO Prisma	0.52	EDPYME Alternativa	0.38
MiBanco	0.49	Financiera Confianza	0.36
CMAC Arequipa	0.46	EDPYME Credivisión	0.34
EDPYME Acceso Crediticio	0.46	EDPYME Solidaridad	0.32
EDPYME Alternativa	0.44	CMAC Huancayo	0.31
EDPYME Credivisión	0.44	EDPYME Raíz	0.29
CMAC Trujillo	0.42	CMAC Paita	0.26
CMAC Pisco	0.39	CMAC Del Santa	0.26
Financiera Crear	0.33	CRAC Sipán	0.24
EDPYME Proempresa	0.28	CRAC Chavín	0.23
EDPYME Nueva Visión	0.28	NGO Fondesurco	0.23
CMAC Huancayo	0.28	EDPYME Proempresa	0.23
CRAC Sipán	0.26	CMAC Pisco	0.22
CRAC Señor de Luren	0.25	CMAC Ica	0.22
CMAC Ica	0.25	MiBanco	0.20
Financiera Confianza	0.24	EDPYME Acceso Crediticio	0.17
CMAC Piura	0.24	CRAC Prymera	0.17
CRAC Cajamarca	0.24	CRAC Libertadores de Ayacucho	0.15
CMAC Del Santa	0.24	CRAC Profinanzas	0.15
CMAC Paita	0.23	CRAC Cajamarca	0.15
CRAC Libertadores de Ayacucho	0.23	EDPYME Nueva Visión	0.14
CRAC Chavín	0.21	CMAC Sullana	0.13
CRAC Profinanzas	0.20	CMAC Arequipa	0.12
CMAC Sullana	0.18	CMAC Maynas	0.12
CMAC Maynas	0.18	CMAC Trujillo	0.12
CRAC Prymera	0.18	CMAC Tacna	0.10
CRAC Credinka	0.17	CMAC Piura	0.09
CMAC Tacna	0.15	CRAC Credinka	0.07
CMAC Cusco	0.14	CRAC Señor de Luren	0.07
EDPYME Raíz	0.11	CMAC Cusco	0.01

Authors' elaboration

In the case of specification 2, the results are similar (see Table 4). Thus, in both years the frontiers are composed mainly by non-regulated MFIs, whereas the positions farthest from the frontier are held mainly by regulated MFIs. However, Fondesurco NGO shows a low level of relative social efficiency, with an efficiency indicator of only 0.23.

Table 4
Social efficiency ranking with poor and female clients as social indicator

2007		2011	
MFI	w_i	**MFI**	w_i
NGO IDER César Vallejo	1.00	NGO Manuela Ramos	1.00
NGO Promujer Perú	1.00	NGO Promujer Perú	1.00
NGO Fovida	1.00	NGO Mide	1.00
Crediscotia Financiera	1.00	NGO Alternativa	1.00
EDPYME Solidaridad	1.00	Financiera Edyficar	1.00
NGO Alternativa	1.00	Crediscotia Financiera	1.00
NGO Mide	1.00	NGO ASIDME	1.00
NGO Adra Perú	0.90	NGO Fovida	1.00
NGO Finca Perú	0.82	NGO Adra Perú	0.93
NGO Manuela Ramos	0.82	NGO Finca Perú	0.93
Financiera Edyficar	0.78	NGO AMA	0.80
NGO ASIDME	0.78	MiBanco	0.78
NGO ARARIWA	0.67	NGO IDER César Vallejo	0.77
MiBanco	0.56	NGO Prisma	0.62
NGO AMA	0.53	CRAC Los Andes	0.52
CRAC Los Andes	0.50	NGO ARARIWA	0.45
NGO Prisma	0.49	CMAC Arequipa	0.44
NGO Fondesurco	0.49	Financiera Crear	0.41
CMAC Arequipa	0.42	Financiera Confianza	0.40
CMAC Trujillo	0.41	EDPYME Alternativa	0.38
EDPYME Alternativa	0.41	CMAC Huancayo	0.33
Financiera Crear	0.25	EDPYME Solidaridad	0.32
EDPYME Proempresa	0.24	CMAC Del Santa	0.29
EDPYME Nueva Visión	0.24	CMAC Cusco	0.28
Financiera Confianza	0.18	CMAC Trujillo	0.28
CMAC Ica	0.18	CMAC Sullana	0.27
CRAC Señor de Luren	0.17	CMAC Tacna	0.26
CMAC Del Santa	0.17	CMAC Paita	0.26
CMAC Paita	0.16	CMAC Ica	0.23
CMAC Huancayo	0.15	NGO Fondesurco	0.23
CMAC Sullana	0.14	EDPYME Proempresa	0.23
CMAC Maynas	0.13	CRAC Señor de Luren	0.17
CMAC Cusco	0.07	CMAC Maynas	0.17
CMAC Tacna	0.05	EDPYME Nueva Visión	0.16

Authors' elaboration

In general, for both specifications and years of the sample, we can observe that the most efficient institutions are NGOs, whereas the concentration of CMAC, CRAC and Edpymes increases the farther one moves from the efficient frontier. These results, in turn, provide preliminary information regarding the link between the institutional nature (the regulatory situation) and the levels of social efficiency in the analyzed MFIs.

The presence of some non-regulated institutions as part of those MFIs that constitute the efficiency frontier is noteworthy. Of particular interest is the fact that they are MFIs of considerable size (where "size" is understood as the number of clients served, as well as the volume of the loan portfolio). This result, however, must be taken into account with caution, to the extent that it could be a reflection of the deficiencies in the utilized indicator of poor clients. This indicator weights the total number of borrowers according to the average loan amounts of the institution (the higher the average loan amounts, the lower the number of served clients is considered, according to the weighting). In this way, even if those institutions may present very high average loan amounts (which may reasonably indicate that they do not tend to serve low-income clients), the high number of clients served by them leaves the "poor clients" number after the weighting still at high levels in relative terms.

5.2 Determinants of social efficiency

In this section, we present the results of the panel data estimations for the period 2007-2011, obtained with the Tobit regression method. These estimations aim to identify those factors that determine the levels of social efficiency of MFIs. Thus, in table 6 the results for three different regressions are provided (according to three different indicators of financial sustainability: OSS, ROA and ROE). These regressions have as dependent variable the indicator of social efficiency that corresponds to the frontiers of specification 1. Table 7, in turn, shows the marginal effects related to those regressions. In all three specifications we show that being a regulated MFI negatively affects social efficiency with a significance level of 1%. On the other hand, the ROA variable appears to positively and significantly affect social efficiency, but only in the third equation.

Table 6
Tobit Regression Results

Variables	P-efficiency		
	(1)	(2)	(3)
Regulated	-0.368***	-0.362***	-0.323***
	(0.112)	(0.112)	(0.111)
Rural	0.0527	0.0643	0.0577
	(0.158)	(0.158)	(0.155)
Individual	-0.0612	-0.0614	-0.0715
	(0.139)	(0.139)	(0.136)
OSS	-0.0345		
	(0.0510)		
ROE		0.00138	
		(0.00123)	
ROA			0.0118***
			(0.00443)
Constant	0.821***	0.757***	0.724***
	(0.0903)	(0.0738)	(0.0732)
Observations	240	236	236

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The marginal effects of the regressors show equivalent signs and significance levels. It's worth noting that the results (especially in the case of regulatory nature's effect on social efficiency) are very similar, independently of the utilized financial sustainability variable. This appears to support the robustness of the result.

It's also necessary to add that equations 2 and 3 were estimated with 236 observations, in contrast to the 240 observations that were employed for equation 1. This is due to the fact that it was not possible to obtain information on ROA and ROE for Edaprospo NGO for the 2007-2010 period.

Table 8 provides the results of the estimations on social efficiency coefficient corresponding to the specification 2 of the efficiency frontiers. The coefficient associated to the dummy variable that reflects the regulatory nature of the MFIs has a negative sign in all cases and is significant at 5% in regression 4 and at 10% in regressions 5 and 6.

Table 7
Marginal Effects of Tobit Regressions

Variables	P-efficiency		
	(1)	(2)	(3)
Regulated	-0.213***	-0.210***	-0.190***
	(0.0631)	(0.0633)	(0.0633)
Rural	0.0305	0.0372	0.0339
	(0.0913)	(0.0914)	(0.0909)
Individual	-0.0354	-0.0356	-0.0420
	(0.0805)	(0.0805)	(0.0800)
OSS	-0.0200		
	(0.0294)		
ROE		0.000798	
		(0.000712)	
ROA			0.00696***
			(0.00263)
Observations	240	236	236

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Additionally, the coefficient of the “rural” variable shows a positive sign and is significant at 1% in all cases. With regard to the financial sustainability variables, we observe that only OSS appears to have a significant and positive effect on social efficiency. The coefficients associated to the ROA and ROE variables in equations 5 and 6 are not significant.

Table 8
Tobit Regression Results

Variables	PW-efficiency		
	(1)	(2)	(3)
Regulated	-0.339**	-0.327*	-0.333*
	(0.166)	(0.171)	(0.171)
Rural	0.677***	0.702***	0.704***
	(0.158)	(0.161)	(0.162)
Individual	-0.254	-0.263	-0.260
	(0.191)	(0.197)	(0.197)
OSS	0.0682**		
	(0.0330)		
ROE		-0.000244	
		(0.00106)	
ROA			-0.00122
			(0.00456)
Constant	0.820***	0.900***	0.902***
	(0.127)	(0.127)	(0.128)
Observations	170	170	170

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9 shows the marginal effects of regressors in equations 4, 5 and 6. We observe that the signs and significance levels bear a relationship with the results shown in Table 8. In the case of the OSS variable, however, we observe that the marginal effect is significant only at the 10% level. Similarly, we observe that just as in equations 1, 2 and 3, the values of the marginal effects appear to change very slightly, regardless of which financial sustainability indicator is used; this constitutes evidence in favor of the results' robustness. In none of the given regressions do the variables referring to credit technology appear to have a significant effect on social efficiency; this situation repeats for the ROA and ROE variables.

Table 9
Marginal effects of Tobit Regressions

Variables	PW-efficiency		
	(1)	(2)	(3)
Regulated	-0.166**	-0.155**	-0.157**
	(0.0777)	(0.0783)	(0.0776)
Rural	0.330***	0.332***	0.332***
	(0.0752)	(0.0743)	(0.0743)
Individual	-0.124	-0.124	-0.123
	(0.0956)	(0.0954)	(0.0954)
OSS	0.0333*		
	(0.0172)		
ROE		-0.000115	
		(0.000498)	
ROA			-0.000574
			(0.00214)
Observations	170	170	170

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In general, all estimations both for specifications 1 and 2 seem to support the notion that the institutional nature of MFIs is a relevant factor influencing their degree of social efficiency; however, a careful interpretation of this result is necessary. The negative effect of the regulatory nature should not be interpreted as the effect of regulation on social efficiency, but rather to the fact that regulated MFIs appear to have particularly different characteristics in comparison to non-regulated MFIs, to the point that it begs the question of whether it is adequate to utilize the DBL approach for analyzing MFIs in Peru as a whole.

On the other hand, it's worth highlighting that, according to the results shown, the closeness to the rural medium seems to be a crucial factor affecting in a positive way the efficiency with which MFIs attend the population in poverty. This is evident, to the extent that in Peru the majority of the population in poverty is located precisely in the rural areas of the country, and engages in activities like subsistence farming.

Finally, a very important result (although less robust) is the one referred to the link between social efficiency and financial sustainability. In effect, the results show that, a priori, both objectives do not appear to be necessarily at odds (instead, according to regressions 3 and 6 they seem to be positively

related). However, an analysis that explicitly inquires into the link between financial sustainability and social reach remains as a task for further research.

6. CONCLUSIONS

The literature on MFIs has repeatedly emphasized the dual nature of this kind of institution, as they not only seek to obtain financial sustainability, but have a social reach mission as well. Thus, the present research has focused mainly on the latter of these objectives, by assessing the degree of social efficiency and its determinants, under which MFIs operate in Peru. To this end, we adopted a combined methodological approach. In the first place, we applied a non-parametric methodology (DEA) which enabled the calculation of different social efficiency frontiers, and a subsequent ranking of MFIs by efficiency levels. Then, on the basis of the thus obtained efficiency indicators, we estimated a Tobit regression model in order to explore their determinants.

The results show that non-regulated MFIs constitute the majority of the most socially efficient institutions. Conversely, those MFIs covered by the regulatory framework show, in most cases, positions far from the efficiency frontier. These results are consistent along all social output specifications and for all the years analyzed in the sample.

On the other hand, the regression analysis reveals that the institutional nature appears to be a relevant determinant in explaining the degree of social efficiency of MFIs. Thus, being regulated affects negatively and significantly the level of social efficiency of MFIs. This result is consistent across all specifications of the regression equation. In the same way, the higher the degree of presence in rural areas, the higher are the levels of MFI social efficiency. This is consistent with the fact that, in countries like Peru, the larger share of the poor population is located precisely outside of the urban areas. On the other hand, there is evidence that financial sustainability could be positively related to social efficiency; however, this result appears not to be that robust, and it would merit additional research focusing explicitly on

this issue. In the opposite extreme, variables like credit technology do not appear to be relevant in explaining MFI social efficiency.

Finally, it's worth highlighting that the link between the regulatory status and the social efficiency of MFIs must be more carefully understood, in as much as it is not possible to directly attribute to regulation a negative effect on MFIs' social performance. The fact that non-regulated MFIs are in general more socially efficient than the regulated ones could rather arise from the different objectives that both types of institutions aim to. Thus, while in Peru the DBL approach could be appropriate for understanding the nature of non-regulated MFIs, it may not be the case for regulated MFIs, for which the social mission appears to be, in most cases, an only declarative objective.

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