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Performance Determinants for Individual Microlending Technology

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Abstract

Increasingly, microfinance institutions are including individual microlending as part of their loan portfolios, and this has been said to be a positive development in the microfinance mission. In this study, we build a borrower's simple decision model in a context of asymmetric information in order to analyze individual microlending (IML) technology and its ability to contribute to development by financing microenterprises, overcoming the limitations of group microlending. We conclude that the collection system holds the key to resolving the problems of adverse selection and moral hazard, although this has not been referred to in previous studies. Our finding are that IML technology is inefficient in offering a product at a cost that might be compatible with microenterprises' average profitability, and therefore they choose not to use it. We provide possible reasons to explain why this technology is more expensive and poses a greater risk than traditional group lending.

Key words: microfinance, individual microlending, lending technology, economic development.
JEL Classification: G21.

Introduction

According to numerous authors, as well as organizations that promote financial inclusion, such as the Consultative Group to Assist the Poor (CGAP, 2007), microfinance's expansion has been positive: it has boosted development and tackled poverty, made loans available under better terms than those offered by money-lenders or self-organized rotating savings and credit associations (Roscas) to people with entrepreneurial talent but who lack funds. It has also increased development by raising the number of loan recipients.

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With the growth and consolidation of microfinance institutions (MFIs), more individual microlending (IML) is available, to the detriment of traditional group microlending. As we will see below, in Mexico, some MFIs have specialized in this type of microlending and it has now become the dominant technology. However, as González and Villafani (2007) point out, unlike group microlending, individual microlending has rarely been the subject of studies and indeed the fulfillment of the microfinance promise (Morduch, 1999) depends on the potential of IML technology.

González (2002) and González and Villafanni (2007), as well as Robinson (2005), state that IML offers the possibility of selecting the top-performing members from groups and offering them larger loans, thus reducing costs per unit borrowed. It is also believed that the construction of an individual credit history can lower the borrower's risk, in turn reducing the risk premium to the advantage of borrowers and their projects, as well as cutting the interest rate applied. Larger loans and lower interest rates for IML will lead to microenterprises performing better.

Therefore, despite the fact that IML is detached from the emblematic solidarity group, these authors assume that credit scaling and direct follow-up eliminate the problem of asymmetric information and therefore the problems of moral hazard and adverse selection. This hypothesis is essential because unless microlending technology is sufficiently robust to counteract these two problems, in order to ensure that the loan offered is in fact oriented toward developing microenterprises, IML could represent a move backward to the very same usurious practices that the microfinance movement sought to overcome in the first place.

In this study we show that: *a*) IML technology cannot depend exclusively on information disclosure mechanisms (such as credit scaling and building a credit history); *b*) IML technology effectively includes an enforcement mechanism that commits debtors' assets; therefore the amount of credit depends on microentrepreneurs' assets rather than the quality of their projects (this mechanism refers to contracts, including unreasonable rates for non-repayment or default); *c*) indeed, including high enough default interest rates eliminates the incentives for moral hazard and adverse selection behavior; *d*) these default interest rates are not determined by competition among different microloan providers, but by the legal costs of collection, making it impossible to state —as frequently alleged in reference to supposed market efficiency— that IML adheres to market

discipline, and *e*) the resulting product, the IML contract, is unattractive to microenterprises with higher-than-average profitability, as evinced by the fact that the product is left almost completely untouched by this productive sector.

Our argument uses a simple (lender-borrower) adverse selection model that we created to show, in the first instance, that information-gathering mechanisms are insufficient to eliminate the problem of adverse selection. This model is shown in the first section.

Then, we modify our previous model to include the status of personal credit and the application of default interest rate charges. In the third section, we use this model to show how adverse selection and moral hazard can effectively be eliminated on the basis of these two conditions reflected in IML contracts. In the fourth section, we examine whether the structure of incentives created by IML technology makes it possible to offer an attractive product for small enterprises. Finally, we assess the crucial mechanism in IML technology. In each case we supply statistical information to back up our conclusions.

In conclusion, given that we show that IML's viability depends on the inclusion of an enforcement mechanism based on an unreasonably high default interest, and that this mechanism is inefficient and risky, in the second section entitled "Compared assessment of IML performance" we contrast IML performance to group microlending; for this purpose we perform an econometric test using a probit model.

Individual microlending technology

The analysis of the borrower-lender relationship under asymmetric information conditions is widely used to explain the type of financial contracts and even the economic role of financial intermediaries (Freixas and Rochet, 1997). Work by Akerlof (1970) on asymmetric information's effects on the market, in this case applied to used cars, is deemed to have sparked many studies on financial markets, particularly those focused on examining credit rationing (Jaffe and Russell, 1976; Stiglitz and Weiss, 1981). As a result of these studies, two types of market failings, adverse selection and moral hazard, have been catalogued and widely accepted.

This analytical perspective, sometimes referred to as the asymmetric information paradigm, is planned in the way that microfinance experts define as lending technology. For González (2002: 109):

> A financial technology is the set of actions and procedures needed to solve problems of information, incentives, and compliance with contracts faced by possible participants in a financial transaction. Any financial technology requires the use of expensive inputs (physical capital, human capital, information).

More focused on lending, Berger and Udell (2005: 2) propose a similar definition:

> We define a lending technology as a unique combination of primary information sources, screening and underwriting policies/procedures, loan contract structure, and monitoring strategies/mechanisms.

We understand that lending technology seeks to create the proper incentives to prevent the problems of adverse selection and moral hazard.

Group microlending technology

The technology that gave rise to the boom in the global microlending movement is based on the creation of groups of jointly liable borrowers (Armendariz de Aghion and Morduch, 2005). It induces self-formation, self-monitoring, and self-sanctioning within groups. Stiglitz (2005 [1990]) shows that peer monitoring creates the proper incentives, so that bad projects are ruled out by the group and there is a tendency to form groups of debtors with the same risk level; also, peers can impose social sanctions in the face of moral hazard.

Gine *et al.* (2006: 4-5) summarize the mechanisms identified by the literature under a situation of group liability:

> This way, group liability is used to harness customers' information about each other and their mutual relationships to the lender's advantage. First, group self-formation provides a screening mechanism that can help to reduce adverse selection (*e.g.*, Ghatak, 1999). In addition, moral hazard can be reduced either by fostering cooperation among group members (*e.g.*, Stiglitz, 1990) or through repeated interactions (Armendariz de Aghion and Morduch, 2000). The group element provides an inducement for members to monitor each other (Banerjee, Besley, and Guinnane, 1994) and to punish each other in the face of moral hazard, possibly through social sanctions (Wydick, 1999; Karlan, 2005a). In sum, group liability can potentially reduce risk-taking and improve the lender's repayment rate.

How does individual microlending technology replace this incentive structure?

Individual microlending: aspects of credit scoring technology

For the purpose of screening borrowers and monitoring debt repayment, microfinance institutions (MFIs) that offer individual lending (IML) usually use a technology that, while based on credit scoring, complements information gathering with *in situ* visits by credit officers. The credit scoring process is oriented toward determining loan applicants' current income and assets, as well as their identity and location. The information's accuracy is mainly verified by cross-checking it with various sources.

If IML were to limit these instruments to information-gathering, it would lack an enforcement mechanism to force its disclosure and thus avoid moral hazard. However, some authors state that enforcement mechanisms are unnecessary. Robinson (2005) suggests that credit officers in charge of screening can find enough information; hence the adverse selection assumption does not apply. Furthermore, González (2002) argues that the policy of improving loan conditions, including the increase in the amounts loaned, according to the borrower's performance, makes it possible to select debtors willing and able to pay. After a study in the Philippines, Gine and Karlan (2006) state that repayment rates are not affected by the shift toward individual liability, which makes it possible to attract new clients. These authors' statement can be summed up as follows: the selection process applied by the MFIs that offer IML can filter the applicants morally willing to make repayments. Let us take a closer look at these statements by using a model.

Borrower-lender model: asymmetric information and limited liability

To evaluate the possibility that individual microlending technology may operate without enforcement mechanisms, or in other words be based solely on the client-selection process, here we propose a simple model using the hypothesis of asymmetric information between lenders and borrowers. It is assumed that the former are not able to see the expected performance of the project that the latter seek to undertake and for which they are requesting the loan. The model's starting point is a standard model of asymmetric information with a limited liability clause (Freixas and Rochet, 1997).

Let us consider a microentrepreneur who is considering whether to accept a loan contract. This is a case of just one of many microentrepreneurs in the market requesting loans, each with an initial wealth $w_0 = 1$. The microentrepreneur in question has two projects for investment —let us say two possible types of microenterprise—, both at a standard cost of 1: the first is a traditional, risk-free project that yields *Rs* constantly (for the sake of simplicity, we assume it to be risk-free, since this does not change the essential argument —in the following section we apply this hypothesis a little more loosely); and the other project entails a risk and yields θe. The variation in the performance of the risky project θe can be represented with a normal distribution with a $\bar{\theta} e$ mean and a σ_e^2 variance. Since we are in a situation of asymmetric information, this distribution is only observable by the microentrepreneur him- or herself. The bank can only observe the average performance of all the microenterprises in the market, which we shall call $\bar{\theta}$, and the average variability rate for all of the microentrepreneurs' projects is σ^2.

Up until this point, microentrepreneurs must decide whether to continue with their traditional project or to invest in a new one entailing risk, due to a lack of wealth to develop both. We assume that our microentrepreneurs, similarly to their peers in the market, have access to credit for financing their risky project. This provides our microentrepreneurs a third possibility: to invest their wealth in a traditional project *Rs* and apply for a loan to finance the risky project.

The loan is offered with limited liability; in other words, the loan's repayment requirement is limited to the result of the project θe. The interest rate (i) for the loan is the same as for all loans since the lender (the bank) cannot monitor each project (asymmetric information). However, the lender does know their distribution as a whole, and therefore it sets the rate i at the same level as the average yield of the project market $\bar{\theta}$. Under these conditions, our microentrepreneur can opt for the following expected performances: *a*) undertake the traditional project with a revenue of *Rs*; *b*) undertake the risky project with a revenue of $\theta_e \rightarrow N(\bar{\theta} e, \sigma_e)$, and *c*) accept the loan: undertake both projects $Rs + (\theta e - i)$.

By including the limited liability clause, this loan exempts borrowers from risk: if their project fails, they are not liable to pay for the losses or to make loan repayment using their own assets. The bank would only recover its loan if the project produced positive cash flows. Being granted a loan under conditions of limited liability gives microentrepreneurs a right to an expected performance

($\bar{\theta}e - i$) without incurring any risk at all and at no cost. And yet microentrepreneurs own the project with the risk; they can sell it (the new microenterprise) at any time and make a profit. Let us assume that the value of the project financed with the loan is ($\bar{\theta}e - i$), therefore the revenue for the project financed with the loan provides no-risk revenue.

With the availability of option *c* (take out the loan), option *a* (invest only in a traditional project) is ruled out, since the poorest performance of option *c* is the same as option *a*, but the expected value of the former is greater than that of the latter (both without risk). Under these circumstances microentrepreneurs should choose option *b* (do not take out the loan and undertake the project using their own resources, taking the risk) or option *c* (take the loan and receive risk-free revenue). The decision will depend on their risk aversion.

In order to factor in the microentrepreneur's willingness to take risk within the model, let us use the traditional method of assuming a level of well-being or utility provided by the revenue and the conditions of risk; let us suppose a simple (risk averse) Von Neuman-Morgenster utility function:

$$\mu(w) = -e^{-p(w)} \qquad [1]$$

where w is the amount to be quantified.

Microentrepreneurs will take the option that offers higher profits; they will take out the loan (option *c*) if it offers a higher profit than taking the risk (option *b*). In other words, they will take out the loan if:

$$\mu(Rs + (\bar{\theta}e - i)) > \mu(\theta e)$$

Using [1], our decision condition is:

$$-e^{-\rho\bar{\theta}e - \frac{1}{2}\rho\sigma_e^2} < -e^{-\rho Rs + (\bar{\theta}e - i)}$$

Therefore the condition is met if:

$$\bar{\theta}e - \frac{1}{2}\rho\sigma_e^2 < Rs + \bar{\theta}e - i, \text{ that is } i - Rs < 1/2\rho\sigma_e^2$$

This implies that they will take out the loan if:

$$i - Rs < \frac{1}{2}\rho\sigma_e^2 \qquad [2]$$

The condition of accepting the loan is summed up as the risk premium payable by microentrepreneurs should they take out the loan (the difference between the rate they pay and the risk-free profit rate, $i - Rs$) being less than the risk discount that, considering the level of risk aversion, is applied by the microentrepreneurs. However, since the interest rate is linked to the average performance, the condition to be met for microentrepreneurs to accept the loan can also be expressed as:

$$\bar{\theta} < \frac{1}{2}\rho\sigma_e^2 + Rs$$

Considering the average revenue of an industry $\bar{\theta}$, microentrepreneurs whose projects have a relatively low risk level and as a result a relatively low discount $\frac{1}{2}\rho\sigma_e^2$ —in particular those with low risk-free revenues— will tend to reject the loan; in other words, this type of loan contract drives away good, low-risk projects with a low opportunity cost. On the other hand, microentrepreneurs with high-risk projects with high traditional revenues will tend to take out the loan.

We reach two conclusions: individual lending technology with limited liability and without enforcement mechanisms a) selects adversely, by attracting more risky projects; and, *b*) tends to attract microentrepreneurs with relatively high traditional revenues, rather than the poorest or those who are fully committed to the new project, thus introducing the possibility of moral hazard.

Individual microlending model: personal loan and default rates

The foregoing conclusions offer a possible explanation for why individual microlending technology in effect in Mexico includes enforcement mechanisms. The simplest example of such an instrument is the possibility for delinquent debtors to be reported to the credit bureau, making them ineligible for credit

for several years. However the crucial enforcement mechanism can be found in clauses on partial or total breach of the loan contract: the ability to demand repayment of the entire debt in case of default and exorbitant late payment rates (additional interest rate in case of default) levied on the total amount of the debt and on the accrued interest charges. This clause is based on the implicit agreement that the loan, granted on an individual basis, is collateralized with any assets held by the borrower.

IML technology usually includes frequent repayments that allow for daily monitoring —weekly installments are quite common. Therefore, any default is detected promptly, triggering the collection mechanism. During the initial default stage, the MFI itself carries out collections, but should the default situation continue, the debt is usually sold to companies specialized in enforcing collection. The default clauses give value to the debt and create the expected resources that make it possible to finance enforced collection, which tends to be fairly aggressive.

Personal loan model and default rate for micro and small enterprises

In order to include the core elements of individual microlending, the model described above was transformed into: *a)* a personal loan (eliminating limited liability), with the borrower's assets implicitly used as collateral, since in fact it is common for microfinance institutions to consider personal goods (televisions, stoves, furniture) as non-explicit collateral, agreed informally and not valued at market price but at the usage price for the debtor (González and Villafani, 2007); *b)* proof of current revenue, and *c)* inclusion of a high additional interest rate applicable in case of default (the so-called default rate).

In order to study microentrepreneurs' decision-making in relation to whether to accept the loan or not, let us suppose that they are currently developing the best micro enterprise, with R revenue and that, considering their risk aversion, they were able to use their own wealth. That is, $R = \max(u(Ri))$ for every project i that is feasible with the microentrepreneurs' own funds. In fact, IML technology —as indicated by the authors referred to above— strives hard to determine R, since this income determines the microentrepreneur's repayment ability. The revenue from the microentrepreneur's current employment R is a random variable, as is the revenue from the additional project θe. For the sake of convenience, let us use a representation with just two events (offers profits

or bankruptcy). In other words, for the base revenue R can take the values R_g (in the case where the microentrepreneur makes profits) and R_q (in the case of losses) with a probability of ϕ_g and ϕ_q, respectively, and θ can take the values θ_g (in the case of profits) and θ_q (in the case of losses) with a probability of π_g and π_q, respectively. The revenue payable for the microloan is expressed as i (including installments and interest payments); m refers to the surcharge in case of default, which occurs as a result of the bankruptcy of both projects. Similarly, we assume that the expected profitability of the new project is at least as good as that currently being developed and that both are sufficient —if successful— to repay the microloan. That is, $i < R_g\phi_g \leq \theta_g\pi_g$.

The expected revenue in case of taking out the loan is:

$$E(R+\theta) = \pi_g\phi_g(R_g+\theta_g-i)+\pi_g\phi_q(R_q+\theta_g-i) \\ +\pi_q\phi_g(R_g+\theta_q-i)+\pi_q\phi_q(R_q+\theta_q-i(1+m))$$

Microentrepreneurs must compare this expected revenue with that obtained in their project R, in other words, for microentrepreneurs to choose to take out a loan, then:

$$E(R+\theta) > R_g\phi_g + R_q\phi_q$$

In order to simplify, let us assume that θ_q and R_q (revenues in case of bankruptcy) are equal to zero, since:

$$\pi_b\phi_b(-i)+\pi_b\phi_m(-i)+\pi_M\phi_b(-i)+\pi_M\phi_M(-i) = -i$$

The condition for entrepreneurs to decide to take out the loan is:

$$\pi_g\phi_g(R_g+\theta_g)+\pi_g\phi_q(\theta_g)+\pi_q\phi_g R_g-\pi_q\phi_q(i)(m) > R_g\phi_g + i$$

In order to simplify, the solvency condition to be met by microentrepreneurs for them to decide to accept the microloan is:

$$\theta_g\pi_g > i[1+\pi_q\phi_q(m)] \qquad [a]$$

For microentrepreneurs to accept the microloan, the expected value must be greater than the repayments and amount of interest, including the expected cost of the default interest charges. This eliminates the possibility of adverse selection, because only microentrepreneurs with projects that offer higher-than-average expected yields will apply (assuming, as in the previous model, that the interest rate is set at the standard level established by the industry in which the borrower is working). Furthermore, moral hazard is also ruled out because the microentrepreneur's current income and assets is being used as collateral.

Evolution of individual microlending and risk indicators

In Mexico, organizations offering microlending-type financial services (especially in the cases of non-profit organizations, small-scale Sofomes [multi-purpose financial corporations] and others) are not tracked, and therefore we do not fully know their scope and characteristics, either individually or as a whole). However, we do know that Prodesarrollo, Finanzas y Microempresa, A.C., an umbrella organization for microfinance institutions, states that "currently our membership is made up of 85 not-for-profit and private-sector financial service providers, catering to the general public, offering products at 1 522 branches across Mexico to more than 4.3 million people, 85% of whom are women" (2010), which gives us an idea of the scope of MFIs in Mexico.

However, global information on microfinance institutions is available on the webpage of MIX Market (2012), an organization specialized in information on microfinance.

> MIXs' primary objective is to increase transparency in the microfinance industry through data collection and analysis. To meet this objective, MIX presents a range of data on MFIs, from financial and operational data, to data on social performance, products and funding structure. Through a prioritization process reviewed and validated by regional microfinance experts, MIX Market displays MFI profiles from developing markets that are most representative of microfinance at each geographical level rather list all MFIs in the world. Smaller actors with a strong commitment to transparency or links to networks where MIX works also appear on MIX Market […] All data submitted to MIX is submitted on a voluntary basis so if you find data is missing on an MFI's profile, it means the institution did not submit that data to MIX or the institution is no longer in operation.

This information includes 24 MFIs operating in Mexico. None of them are public and the list includes non-governmental organizations (NGOs), Sofomes,

and one bank; together they offer a service across Mexico, most operating in at least three states but with a stronger presence in the south of the country. It is worth noting that the sample includes two large MFIs that share the market with other, much smaller operators (refer to Table 1 for more details).

Although the MIX Market database offers some information on MFIs in Mexico for the years prior to 2004, it was only from that year when the sample began to offer information about at least 11 MFIs operating in Mexico; by 2005 the sample increases to 19 MFIs, reaching a peak of 24 that were registered in 2007. We used this information to put together an unbalanced panel for the 2004-2011 period. The financial information offered by MIX Market is complemented with that sourced from the websites of the MFIs included in this sample. The published variables that we used consist of standard financial and other ratios (*e.g.*, average loan balance) that MIX Market calculates on the basis of nominal variables expressed as current dollars. It includes the most recent information at the time of the analysis, but we should point out that the 2004-2011 period is when Mexico's microfinance market expanded and became consolidated; therefore the sample and the period are relevant for studying microlending performance.

Using this panel, and in order to obtain a profile of how MFIs developed in the area of individual microlending, we classify them as shown in Table 1.

Table 1
Percentage of MFIs in the sample, by type and change of microlending offer, 2004-2011

0: continued offering solely group loans	*1: changed from offering solely group loans to offering both*	*2: continued offering both*	*3: changed from offering both to solely individual loans*	*4: changed from offering solely group loans to solely individual loans*	*5: continued offering solely individual loans*
12.5	8.3	58.3	12.5	0.0	8.3

Source: Compiled by author using data from MIX Market. Available at: <http:// www.mixmarket.org> [Accessed in March 2013].

We can observe that 87.5% of the MFIs in this sample offer IMLs. It is also worth pointing to the high level of concentration in the microloan market, since in the sample two companies concentrate almost 76% of the microloan offer: the first accounts for 45.5% of microloans, specializing in group loans

for women, and now also individual loans; the second has been fully focused on IMLs since its founding, supplying 30.4% of microloans on average during the period analyzed.

Some data on handling IML risk

The ability to handle adverse selection and moral hazard must be reflected in a reasonably low level of portfolio at risk. We used the portfolio at risk index (RPAR: ratio of total portfolio at risk to total loan portfolio) and the reserve formation index (RProvisionPort: ratio of reserves to total loan portfolio). As shown in Table 2, in line with the results of the theoretical analysis carried out, the average RPAR of the MFI specializing in IML (cases 3 and 5) and, as a result, the RProvisionPort, are significantly higher than the MFIs that maintain the traditional group-lending technology.

Table **2**
Average values of portfolio at risk and provisions

	0: continued offering solely group loans	*1: changed from offering solely group*	*2: continued offering both*	*3: changed from offering both to solely individual loans*	*4: changed from offering solely group loans to solely individual loans*	*ANOVA F-test*	*Sig.*
RPAR	3.7%	3.1%	3.3%	6.0%	18.2%	9.232	0.000
RProvisionCart	3.9%	3.1%	3.2%	5.5%	15.5%	18.660	0.000
RCoverage	1.606	0.911	1.274	0.483	0.716	0.464	0.761

Source: Compiled by the author using data from MIX Market. Available at: <http:// www.mixmarket.org> [Accessed in March 2013].

As we will see below, this calls for a closer analysis of the strength of IML technology, based on a collections system financed by a high default surcharge.

Users of microloans

The condition represented by inequality [a] indicates that the interest rate together with the default surcharge becomes the instrument that determines which projects will request IMLs. If the MFI is able to offer interest rates at the

average level of the corresponding industry, $\theta_g \pi_g > i[1+\pi_q \phi_q(m)] = \bar{\theta}$, loan applications will be received from microentrepreneurs who have good projects and are able to pay the rate. If the technology were inefficient, MFIs would be forced to set rates above the industry's average performance and, as a result, microentrepreneurs would not be interested. Unfortunately, as shown in Table 3, the data we have obtained indicate that, indeed, microentrepreneurs do not take out microloans. Admittedly, few studies have been carried out on the real effect of microfinance on poverty reduction. The empirical study by Cotler and Rodríguez (2010) is an exception, but it does not differentiate between users from cooperatives or private microfinance organizations with completely different lending technologies. In any case, the effect can only come into play if microloans are requested. Therefore, we simply asked owners of microenterprises if they used them, and they replied that they did not.

Table **3**
Microenterprises that have never used the service
(percentages)

Loans from moneylenders (usurers) *	95.2
Loans from microfinance institutions *	99.2
Bank credit card **	77.8
Fixed-asset loan **	92.7
Mortgage loan **	94.6
Working capital loan **	92.7

Notes: */ Data from 2006. **/ Data from 2011.
Source: survey carried out in the city of Chetumal, Quintana Roo.

The fact that the MFIs that offer IML usually charge interest rates above 100% for their microloans, and that the total annual cost (TAC) of some of these products can be over 200%, suggests that interest rates are the main reason why microenterprises decide against taking out microloans. On analyzing the rates involved (RPortPerf), we can see, in Table 4, that IML might not represent progress for group microloans in terms of cost, since these rates are not statistically different. The same is true with the average loan amount per delivery (AveLoan) and per borrower (RLoansperBorrower). We should highlight that MFIs that solely offer group or solely individual loans are those with the highest implicit rates; and the loan amounts are much higher for those solely offering

IMLs; this can be explained by the strategy of scaling amounts loaned according to the repayment rate.

Table 4
Implicit rate and average loan amount in US dollars

	0: continued offering solely group loans	*1: changed from offering solely group loans to offering both*	*2: continued offering both*	*3: changed from offering both to solely individual loans*	*5: changed from offering solely group loans to solely individual loans*	*ANOVA F-test*	*Sig.*
RPortPerf	84.5%	56.2%	60.2%	63.9%	71.9%	1.077	0.397
AveLoan	222.12	293.99	595.70	745.16	450.32	0.245	0.909
RLoansperBorrower	216.00	285.95	560.78	851.88	470.75	0.463	0.762

Source: Compiled by author based on data from MIX Market. Available at: <http:// www.mixmarket.org> [Accessed in March 2013].

Although statistically the implicit rates are not different, the cost of IML is in fact higher than that observed in the already excessive TAC costs, since the true cost must include the expected value of the default rate. Nevertheless, debtors do not factor in these costs until they are in arrears.

If not microenterprises, then who is willing to pay these rates?

The condition expressed in the inequality [a] operates as a budgetary limit for the demand of IML. If applicants were to behave as risk-adverse agents, the conditions of access would become even more apparent since, using the same Arrow Debreu (A-D) function of risk aversion, the condition for applying for a loan also includes the risk premium.

$$\theta_g \pi_g > i[1+\pi_q \phi_q(m)]+\frac{1}{2}\rho\sigma_e^2$$

Risk-inclined agents?

Users of individual microloans probably face exceptional situations that make them inclined to take risks (giving a very low weighting on loan losses and

very high weighting for successes, for example, in the case of medical or family emergencies) or perhaps they might be agents that respond to a different rationale than that contained in a such a simple function as that of A-D. This study is limited to describing these possibilities that we incorporate into our research agenda.

Determinants of the default rate

In case of default, an event with a probability of $\pi_f \phi_f$ in the model we are showing, individual microlending is backed up by the debtor's assets. However, the collection process is difficult and expensive, since it takes place just when the debtor has failed in both projects (let us recall that technology guarantees that borrowers have revealed their true identity). In this distressing situation, the transfer of the debtor's assets becomes a painful legal proceeding.

To finance the enforced collection process, IML technology foresees the application of a surcharge in case of late repayment and this must enable the financing of all collection costs. Let us give the term M to the cost of non-repayment (the non-repayment cost expressed in the terms of the value of an asset with a value equal to 1). We assume that this debtor honors the contract (makes the loan repayments and pays the interest) only when the compliance cost is less than the default cost. If the latter costs were fixed (limited to an amount M, irrespective of the size of the loan), the debtors of sufficiently large loans (so that $i > M$) would have motive to default on the loan. That is why IML technology makes these costs variable adding the default rates; therefore, the cost of defaulting is linked to the loaned amount.

However, investing M in legal proceedings does not guarantee debtors that they will avoid having to repay and prevent an embargo following a court order. This means that the assessment of the payable cost in case of default is probabilistic. The expected cost for the debtor, in the case of legal proceedings, is (assuming a binomial function):

$$P_e(M) + (P_f)(M + [i(1+m)]$$

where P_e is the probability of success in case of legal proceedings (non repayment) and the probability that the debtor does not avoid repaying is $P_f = (1 - P_e)$. The condition for the debtor to decide not to avoid repaying the

loan is for the cost of the loan (complying) to be less expensive than the cost of not repaying it:

$$i[1+\pi_m\phi_m(m)] < P_e(M) + P_f(M+[i(1+m)]$$

Removing the surcharge for default interest m, we observe that:

$$m > \frac{P_e - (M/i)}{P_f - \pi_m\phi_m}$$

guarantees that, for any positive performance resulting from the failure to pay when due, it is more profitable for the debtor to make the repayment.

A further pressure exists for increasing surcharges in case of default: it is not simply a question of discouraging moral hazard-type actions but also it must enable financing of the cost of collection specialists. Indeed, the default rate must also be enough to pay for the services of specialist collection agencies.

The use of these specialists is another distinctive aspect of IML technology. The cost of paying for punitive measures is covered by the interest rate itself. Where C is the collection cost, the default surcharge payable shall be:

$$m = \max[C; \frac{P_e - (M/i)}{P_f - \pi_m\phi_m}]$$

Legal proceedings that are slow and unreliable in reaching decisions increase the probability of the success of defaulting P_e, as well as the collection costs C, thus increasing the default rate m. Also, the higher the interest rate charged for the microloan, the default rate must be even higher still in order to discourage default. Given that interest rates charged by microfinance institutions are usually ten times higher than the reference rate by cost of the money, the resulting default rates are unreasonable in practice.

IML technology is based on the ability to collect, but this system requires high default rates to be imposed, since the costs depend on the effectiveness of the justice system and not on some productive activity influenced by a competitor.

Compared assessment of IML performance

Our analysis revealed that IML technology is risky on account of its requirements for how defaults are managed; hence it would be expected that the risk premium applied in the IML interest rate would be higher than that used for group lending. However, IML costs would be expected to be less, given that it uses credit scoring systems and that it should offer higher amounts.

An initial study of the relationship between the efficiency of IML technology, assessed according to productivity indicators (see Table 5), indicates that the process of IML transformation and inclusion has led to a differentiation between productivity levels. The MFIs that offer these loans use computerized credit-scoring systems. Therefore, their cost indicators in general are less than traditional MFIs that only offer group microloans. In fact, the productivity of loan officers in the MFIs that offer IML is not clearly higher by loan officer (RLoanbyOffic), but it is when we examine the operating cost of operation per client (RClientOpCost).

Table 5
Productivity indexes

	0: continued offering solely group loans	*1: changed from offering solely group loans to offering both*	*2: continued offering both*	*3: changed from offering both to solely individual loans*	*5: changed from offering solely group loans to solely individual loans*	*ANOVA F-test*	*Sig.*
RLoanbyOffic	167.7	251.7	269.0	181.3	312.4	0.439	0.779
RClientOpCost	249.10	118.58	168.32	368.60	198.44	2.950	0.047
ROpAssetCost	0.613	0.314	0.279	0.374	0.339	4.478	0.010
RPortOpCost	1.298	0.420	0.388	0.528	0.417	7.061	0.001
RTotAssetCost	0.657	0.389	0.339	0.437	0.440	4.482	0.010

Source: Compiled by author based on data from MIX Market. Available at: <http:// www.mixmarket.org> [Accessed in March 2013].

Also, the operating cost and total cost, in relation to the asset are, on average, higher in MFIs that are focused exclusively on group loans, indicating the existence of economies in IML.

In terms of profitability and debt, this initial study shows us that, on average, in the 2004-2011 period, the asset's profitability was higher in the MFIs that offer IML: as can be seen in Table 6, financial self-sufficiency [FinSelfSuf: financial revenue/(financial expenses + operating expenses + provisions)], both as a pre-tax profit measured in relation to the total asset (RProfBAsset), are markedly lower in MFIs that offer solely group loans. The ratio of net (after-tax) profit on capital (RProfCap) does not reveal significant differences, similarly to the asset-to-capital ratio (RCapAsset) and the debt-to-capital ratio, which could be explained if the different debt capabilities do not obey the type of product being offered.

Table 6
Profit and debt ratios

	0: continued offering solely group loans	*1: changed from offering solely group loans to offering both*	*2: continued offering both*	*3: changed from offering both to solely individual loans*	*4: changed from offering solely group loans to solely individual loans*	*ANOVA F-test*	*Sig.*
FinSelfSuf	0.731	1.055	1.138	0.970	1.153	2.325	0.094
RProfBAsset	–0.172	0.017	0.039	–0.010	0.062	2.733	0.060
RProfCap	–0.490	0.155	–0.183	0.006	0.185	0.252	0.905
RCapAsset	0.344	0.378	0.309	0.180	0.595	1.600	0.215
RDebtCap	2.434	2.128	3.350	5.003	1.256	1.039	0.413

Source: compiled by author based on data from MIX Market. Available at: <http:// www.mixmarket.org> [Accessed in March 2013].

As we saw in Table 4, the portfolio at risk is on average higher in MFIs offering IML, hence the risk premium can be the factor that explains why this type of MFI enjoys greater profitability for its asset.

Differentiating individual microlending technology

Below we present our test to compare these variables as a whole. In order to identify which variables determine the probability that an MFI might offer IML, we applied a set of econometric tests using the panel data described a few pages above.

The basic tests refer to the variable called individual, which is binary and indicates with a one if the MFI in question offers IML, and with a zero when it solely offers group microloans. Our aim is to determine if the productivity, risk, average loan, or profitability indicators can explain the difference between individual and traditional lending technology. With this aim, we will validate the hypothesis that the IML technology is less productive, expressed as a negative sign of the indicators of total asset cost (RTotAssetCost) or the operating asset cost (RPortOpCost), given that an MFI offering IML is forced to engage in an excessive effort in the follow-up and collection process. Also, IML technology could be more risky, which would be expressed in portfolio at risk indexes RPAR and higher amounts of coverage reserves (CoverageR). It is also expected that IML technology may tend to increase the average loan, which will be evaluated with a positive sign of the average loan indexes (AveLoan) or in the loan-to-borrower ratio (RLoansperBorrower). Finally, given that our analysis indicates that the IML offer is oriented toward people with high intertemporal discount rates, or with little information, we consider the possibility that high risk premiums are expressed in high gross profits or profitability indexes. These are expressed in the ratio of gross portfolio performance (RPortPerf), financial self-sufficiency (FinSelfSuf), or the gross profit-to-asset ratio (RProfBAsset).

$$\begin{aligned} \textit{individual} = f\,[&\textit{productivity}(-);\ \textit{risk}(+);\\ &\textit{average loan}(+);\ \textit{profit}(+)] \end{aligned}$$

These variables were subjected to an individual test that is shown in Table A1 of the appendix. Of these, those which were significant were selected to explain the endogenous variable —the so-called individual one— and they were later evaluated together. The results of the combined tests are shown in Table 7 and are compatible with the conclusions presented throughout this text.

Although the average loan and profit indicators express the expected positive sign, the risk and productivity indicators were not found to be significant, which is not compatible with the tests presented above. We then undertook a further test to evaluate the variable risk, but now using the group variable. This variable takes the value of one if the MFI offers group microloans and zero if it does not offer them during the year in question. We evaluated whether this variable can partly be explained by the risk indicators. Table 8 shows the results.

TABLE 7

Econometric tests

Applied method: ML-Binary Probit (Quadratic hill climbing); using an unbalanced panel

Period: 2004-2011 (135 observations).

Independent "individual" binary variable indicates whether during the year in question the MFI offered IML

	Risk		**Size**		**Profit**			**Productivity**				
	RPAR	*CoverageR*	*RLoansper-Borrower*	*AveLoan*	*RPortPerf*	*FinSelfSuf*	*RProfBAsset*	*RTotAssetCost*	*ROpAssetCost*	*C*	*Akaike*	*McFadden R-2*
Coefficient	5.309		0.007			2.075		–1.734		–2.832	0.623	0.469
Standard error	7.147		0.002			0.847		1.202		1.467		
Z-Score	0.742		3.021			2.449		–1.442		–1.929		
Probability	0.457		0.002			0.014		0.149		0.053		
Coefficient		0.095	0.006			2.134		–1.850		–2.598	0.684	0.442
Standard error		0.117	0.001			0.832		1.118		1.367		
Z-Score		0.809	3.379			2.564		–1.653		–1.900		
Probability		0.418	0.000			0.010		0.098		0.057		
Coefficient	3.267			0.006		1.947		–1.628		–2.471	0.671	0.401
Standard error	7.113			0.002		0.860		1.216		1.431		
Z-Score	0.459			2.971		2.262		–1.338		–1.726		
Probability	0.646			0.003		0.0237		0.1806		0.0842		
Coefficient				0.004			2.564		–3.101	–0.022	0.745	0.326
Standard error				0.001			1.312		1.489	0.607		
Z-Score				3.178			1.953		–2.082	–0.037		
Probability				0.0015			0.0507		0.0373	0.9703		
Coefficient			0.006			2.6318			–2.353	–3.414	0.640	0.451
Standard error			0.001			0.717			1.234	0.940		
Z-Score			3.552			3.668			–1.907	–3.630		
Probability			0.000			0.000			0.056	0.000		

Table 8
Econometric tests with a single independent variable
Applied method: ML-Binary Probit (Quadratic hill climbing)
using an unbalanced panel
Period: 2004-2011 (135 observations)
Independent "group" binary variable indicates whether
during the year in question the MFI offered IML

Variables	*Independent variable*			
	Coefficient	*Standard error*	*Z-Score*	*Probability*
		Risk		
RPAR	–36.46	6.666	–5.470	0
CoverageR	0.487	0.219	2.221	0.026
		C		
	Coefficient	*Standard error*	*Z-Score*	*Probability*
		Risk		
RPAR	2.695	0.373	7.208	0
CoverageR	0.579	0.188	3.081	0.002
	McFadden R-2		*Akaike*	
		Risk		
RPAR	0.402		0.636	
CoverageR	0.054		0.882	

In general, our tests do not reject the hypothesis that if the average amounts of each microloan offered by an MFI are relatively high (thus offering advantages in terms of productivity) but their productivity is not clearly higher (which we argue is due to higher collection costs), and this MFI's profitability is relatively higher (which we argue is due to a higher risk premium) and the risk indicators are not clearly lower than the group ones —but the group ones are clearly lower, which we argue is due to the fact that collection technology is riskier than with group lending—, then it should be an MFI that offers IML. In line with this theoretical analysis, IML technology, based on its collection system, appears to be riskier, and ultimately more expensive, than traditional technology based on group liability.

Conclusions

The analysis presented here indicates that, although the relevant literature has not made this finding, individual microlending technology needs and includes

enforcement mechanisms to tackle the possibility of adverse selection and moral hazard. The central instrument of the technology under analysis is the collection system that, since it is based on an aggressive collection process financed by default rates, is successful in preventing moral hazard and adverse selection. The portfolio at risk index and the enormous growth in the number of MFIs offering IML can be considered evidence of this success.

However, once we incorporate the collection system into our model, we found that microentrepreneurs would submit projects with higher-than-average expected performances and with low-risk premiums; technology makes it possible to overcome moral hazard and adverse selection. But it also implies that if microlending costs are set far above microenterprises' average income, microentrepreneurs will not apply for loans. The results from interviews with microenterprises indicate that users of IML are not microenterprises; in other words, IML technology in Mexico is not efficient enough to offer an attractive product to the country's microenterprises.

Our theoretical and empirical analysis shows that the inefficiency of this technology is explained by the fact that, although the enforced collection mechanism obliges the proper disclosure or the borrower's current income, on the other hand it displays two major flaws: it is very expensive and does not guarantee recovery, since it is applied just when the borrower has the lowest income. In effect, our analysis shows that the collection mechanism, financed by unreasonable default rates, depends on the justice system and out-of-court collection mechanisms that make them very expensive and uncertain, which could explain the higher profits of incorporating a higher risk premium.

IML technology is inefficient at offering interest rates that correspond to the average performance of microenterprises. Our study has shown the determinants of this inefficiency and has offered empirical evidence in this regard. However, MFIs offering IML are flourishing, hinting at the possibility that MFIs offering IML have taken a course unrelated to economic development.

According to the definition of the Spanish-language dictionary, the *Diccionario de la Real Academia Española* (DRAE 2001), "usury" refers to loans made at an unreasonably high interest rate. If, in the end, microloans are in fact expensive personal loans that are not targeted at helping microenterprises to develop, we could examine the possibility that when we refer to IML, we may be referring to overly expensive loans used by people without access to proper information or in high-risk situations (at times when one peso is much more useful to them than the risk that it entails), which could be considered usury.

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Appendix

Initial econometric tests

Table **A1**

Econometric Tests with a Single Independent Variable

Applied method: ML-Binary Probit (Quadratic hill climbing) using an unbalanced panel
Period: 2004-2011 (135 observations)
Independent "individual" binary variable indicates whether during the year in question the MFI offered IML

Dependent variables	**Independent variable**				**C**					
	Coefficient	*Standard error*	*Z-Score*	*Probability*	*Coefficient*	*Standard error*	*Z-Score*	*Probability*	*McFadden R-2*	*Akaike*
					Risk					
RPAR	7.343	4.613	1.591	0.111	0.482	0.214	2.251	0.024	0.0273	1.037
CoverageR	–0.086	0.066	–1.304	0.192	0.943	0.138	6.804	0	0.010	1.015
					Size					
RLoansper-Borrower	0.006	0.001	4.356	0	–1.196	0.412	–2.903	0.003	0.255	0.813
AveLoan	0.006	0.001	3.732	0.000	–1.076	0.468	–2.298	0.021	0.226	0.819
					Profit					
RPortPerf	–1.206	0.522	–2.310	0.020	1.666	0.393	4.236	0	0.044	1.000
FinSelfSuf	2.319	0.520	4.456	0	–1.515	0.522	–2.900	0.003	0.180	0.869
RProfAsset	3.049	0.956	3.188	0.001	0.806	0.127	6.311	0	0.113	0.952
					Productivity					
RCtesxOffic	0.001	0.000	1.880	0.06	0.374	0.219	1.704	0.088	0.031	1.065
RTotAssetCost	–3.403	0.742	–4.583	0	2.348	0.369	6.363	0	0.186	0.868
ROpAssetCost	–3.404	0.727	–4.682	0	2.100	0.313	6.698	0	0.189	0.872
RPortOpCost	–1.929	0.571	–3.378	0.000	1.294	0.201	6.434	0	0.080	1.005
ClientsperStaff	0.003	0.001	1.740	0.081	0.425	0.236	1.797	0.072	0.029	1.027