Financial liberalization and the development of microcredit

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Abstract

We analyze a competitive credit market characterized by adverse selection, in which lenders (banks) are endowed with a screening technology whereby devoting enough time to process a loan application, they can extract an informative signal about the quality of the applicant. The time necessary for signal extraction depends on the degree of a borrower's informational transparency. In the presence of opaque and transparent borrowers – either a pooling equilibrium (PE) or separating equilibrium (SE) prevails. In the PE, banks only supply credit conditional on a positive outcome from screening – which results in credit rationing. In the SE, opaque borrowers self-select into contracts that are characterized by comparatively low waiting time, high cost of credit, and no rationing (microcredit); while transparent borrowers self-select into loan contracts characterized by comparatively high waiting time, low cost of credit, and rationing (standard credit). Within this modeling environment, interest rate ceilings might cause financial repression by forcing a PE in cases where a laissez-fraire economy would instead have yield a SE equilibrium where banks operate both microcredit and standard credit. We test the model's main insights using data from the Colombian banking sector, which underwent a financial liberalization process in December 2006.

Keywords: Microcredit, Asymmetric Information, Bank Downscaling, Usury Rates

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1 Introduction

Alas in its beginnings microcredit mostly referred to small uncollateralized loans to the poorest of the poor offered via group-lending contracts by a solidarity organization, currently the market for microcredit involves much more heterogeneous contract terms and composition of lenders and borrowers. This shift can be attributed to the significant and increasing presence of commercial banks in the market, alongside and/or competing with specialized microfinance institutions and NGOs. Commercial banking has arguably created new balances in the mission of microcredit by combining two previously separate institutional logics, e.g. a development logic guided towards helping the poor and a banking logic requiring profits to support operations, see Battilana and Dorado (2010). On this, Cull, Demirgüç-Kunt and Morduch (2007 & 2009) found that microfinance banks, when compared to NGOs or non-bank financial institutions, exhibited inclinations towards individual lending over group-lending, granting loans of greater volume and serving a customer base who are substantially better off. Evidently these banking institutions do not typically replicate the outreach and methods of non-for-profit organizations.

Table 1 contains data on the breadth, outreach, management practices and financial performance of the sample of worldwide NGO and bank microfinance institutions (MFIs) surveyed by the Microfinance Information Exchange (or MIX) for the 2004-2012 period. **Appendix 1** offers a description of the variables and summary statistics presented. The data on Table 1 is consistent with the multiple findings in the literature arguing bank MFIs have different approaches and social objectives, and offer distinct loan contracts from their NGO counterparts. The data is presented along three sub-periods each of three years, e.g. 2004-2006, 2007-2009 and 2010-2012. For each of these sub-periods, respectively, MIX contains data on 358, 467 and 446 unique NGO MFIs and on 94, 167 and 180 unique bank MFIs. None of the surveyed NGO MFIs included in the data are for-profit institutions and most are unregulated by their respective country's financial authorities, and almost all of surveyed bank MFIs are for-profit regulated entities. Of these two types of MFIs, Bank MFIs are the fastest growing rate at each sub-period. Consistent with the tradeoff between outreach and breadth that is broadly reported in the literature, the outreach of NGO MFIs is significantly smaller than that of the banks, and their target market is located at the low end while that of bank MFIs is a much broader. The percentage of female borrowers from NGO MFIs exceeds that of male borrowers, not the case for bank MFIs, and loan officers at bank MFIs originate and service a significantly larger amount of loans than those at NGO MFIs. These suggest stark differences in the composition of borrowers and the practices for screening and servicing of debt among each kind of MFI. The average sizes of the loan portfolios and of the total assets of bank MFIs greatly exceed those of NGOs, and such disparities have only become greater with time. While the average number of active borrowers per institution and loan loss rates are comparable for both types of institutions, the average loan size and the cost per loan are sufficiently larger at bank MFIs. The real yield on the gross portfolio, often used as a proxy on the lending rates, has been consistently higher for

Table 1: Descriptive statistics on worldwide NGO and Bank MFIs

Variables	MFI type	2004-2006	2007-2009	2010-2012
Total Microlenders	NGO	358	467	446
	Bank	94	167	180
For Profit	NGO	0%	0%	0%
	Bank	97%	99%	99%
Regulated	NGO	25%	25%	26%
	Bank	98%	99%	99%
Age	NGO	55% 27% 18%	66% 20% 13%	78% 15% 7%
{Mature Young New}	Bank	53% 26% 22%	43% 15% 42%	45% 17% 38%
Outreach	NGO	64% 24% 12%	61% 23% 15%	63% 20% 17%
{Small Med Large}	Bank	24% 33% 43%	41% 21% 39%	46% 21% 32%
Target Market	NGO	2% 3% 32% 63%	1% 3% 36% 60%	1% 2% 39% 58%
{SmBus Hi Broad Lo}	Bank	23% 20% 42% 15%	20% 18% 44% 19%	21% 16% 41% 22%
% Female Borrowers	NGO	73.30%	67.80%	71.50%
	Bank	54.70%	49.20%	45.80%
Loans / Loan Officer	NGO	317	323	316
	Bank	455	930	775
Loan Portfolio	NGO	$6,419,679	$11,857,450	$15,330,939
	Bank	$121,834,521	$256,813,796	$423,040,043
Assets	NGO	$122,687,499	$217,499,170	$242,167,743
	Bank	$662,280,503	$1,366,728,110	$9,525,845,877
Borrowers	NGO	1,273,495	1,466,450	1,214,570
	Bank	1,468,213	1,656,551	1,495,455
Loan Loss Rate	NGO	0.90%	1.80%	1.90%
	Bank	0.60%	1.20%	1.00%
Loan Size	NGO	$736	$1,283	$953
	Bank	$2,555	$5,847	$16,606
Cost per Loan	NGO	$93	$116	$154
	Bank	$299	$413	$1,492
Lending Rate	NGO	23.20%	21.90%	23.40%
	Bank	17.30%	11.70%	9.30%

NGO MFIs along all considered sub-periods. In addition to this rate being consistently lower for bank MFIs, on average, along the considered time period it has been decreasing for these institutions; this is not the case for NGOs.

The interest of commercial banks in microfinance is been reported to be motivated by the expected profitability of microcredit loans, the existence of government regulations requiring microcredit lending by the commercial banking sector, the opportunity for the bank to show its corporate social responsibility [Hermes and Lensink (2011)], and the loss of clients for traditional banking services to bigger international banks [Schicks (2007)]. The process by which commercial banking institutions enter the microcredit market, while still primarily offering traditional banking products, is commonly referred as "downscaling".

Screening procedures typical of traditional commercial banking practices are of limited effectiveness when applied to opaque and unbanked prospective borrowers. These are bound to significantly increase bank's costs, in such a way that it would be unprofitable for commercial to issue uncollateralized commercial loans to them. As a result, the possibilities of securing traditional bank credit for unbanked and informationally opaque individuals and firms are reduced, strenghtening their dependence on the informal finance sector.[1]

Commercial bank downscaling into the microcredit market is therefore characterized by organizational adjustments intended to more efficiently originate and service debt to such a specific population of unbanked and opaque borrowers. This is typically done by creating a specialized internal unit within the bank, outsourcing micro-lending operations to an external organization, or by creating a regulated subsidiary.[2]

We explore the coexistence of microcredit downscaling for a bank alongside its standard loan practices, in a model of a competitive credit market characterized by adverse selection. Potential borrowers are impatient, and heterogeneous both with respect to their ability to repay loans and to the degree of informational transparency about such ability. Lenders (banks), while not informed about borrowers' type, have access to a costly screening technology such that – by devoting enough time to screen applicants – they can extract an informative signal about their type. According to such technology, the waiting time necessary to extract a meaningful signal about borrowers' type depends on the degree of informational transparency of borrowers. It takes less time to extract a signal in the case of transparent borrowers than in the case of opaque ones. The equilibrim in the laissez faire economy is generally

[1] See Morduch (2000), Presbitero and Rabellotti (2013), Berger, et. al. (2001), Clarke, et. al (2005) and Petersen and Rajan (1994) for discussions of the ineffectiveness of standard commercial bank practices when addressing opaque and unbanked borrowers, and Chandavarkar (1992) for a discussion of how this affects unbanked borrowers' reliance on informal finance.

[2] CGAP (2005) reviews different general methods followed by bank that have succesfully entered microcredit markets. Schoombee (2004) for South Africa, and Westley (2006) and Prior and Argandoña (2009) for Latin America offer very complete accounts and examples on ways in which traditional banks downscaled into microcredit.

unique, and it involves either separation or pooling, depending on parameter values. In the pooling equilibrium (PE) banks offer just standard credit contracts characterized by a screening process. As a result, borrowers' cost of credit is relatively low, while all loan applicants face a positive waiting time and are rationed with a positive probability. To the extent that extracting information requires more time in the case of opaque borrowers, rationing implies that opaque borrowers display a lower rate of credit market participation per unit of time. In the separating equilibrium (SE), banks offer a menu of two contracts. A standard credit contract as the one described above, and a microcredit contract, characterized by a higher cost of credit, no screening, no rationing and a lower waiting time. As a result, borrowers' participation to the credit market increases – compared to the PE case.

In the proposed modeling environment, interest rate ceilings (anti-usury rates) can result in financial repression to the extent that they can prevent the occurence of a SE as the one previously described. Hence, removing interest rate ceilings can foster the development of microcredit. Traditional banks are often dissuaded from downscaling to microcredit on markets where anti-usury rates are present. Being these organizations classified as financial institutions, subject to national regulation on financial intermediation, will bind their microcredits contracts to the interest caps determined by the usury rates,[3] and anti-usury rates are often associated with financial repression.[4] In other words, the model explains the apparent relation reported in the literature between development of bank microcredit and financial liberalization; see, for instance, Johnson (2004), Tsai (2004), Rhyne & Otero (2006), and Beck & Demirgüç-Kunt (2008). In the case of Colombia, for instance, the volume of microcredit from bank MFIs went from a yearly average of $483 millions USD in the three years prior to the financial liberalization process, characterized by the relaxation of interest rate ceilings that took place at the end of 2006, to $1,538 millions USD in the three years immediately following the reform, and $3,443 millions USD during the three years after those.

A considerable number of microfinance promoters and practitioners, with Nobel Laureate Muhammad Yunus among these[5], have expressed concerns about the growing commercialization of microcredit and an inevitable primary focus on profitability over poverty reduction of microcredit financial institutions [Copestake (2007)]. This while commercial capital is seen by its proponents as a necessary and a more efficient supplier of credit to the unbanked, The work by Cull, Demirgüç-Kunt and Morduch (2009) found that the highest fees on microcredit are being charged by institutions driven by a social mission and not by commercial microfinance institutions, and attribute most of this discrepancy to the

[3]This restriction does not regularly apply to NGO MFIs. Refer to Table 1 for the descriptive statistic on the incidence of regulated NGO MFIs vs bank MFIs, and to Peck Christen and Rosenberg (2000) for an account on how for a long period unregulated NGOs in Latinamerican countries benefited from being exempt of anti-usury laws in their home countries.

[4]Financial repression resulting from anti-usury laws has been well-established by a considerable number of important works in the scientific literature. A non-exhaustive list of these include Stiglitz and Weiss (1981), McKinnon (1984), McKinnon (1989), Villegas (1989), Chandavarkar (1992), Homer and Sylla (1996), Glaeser and Scheinkman (1998), Dehejia et. al. (2005), and Rigbi (2013).

[5]Reference, for instance, Yunus (2007).

cost structure of both organizational types. Hermes and Lensink (2011) further claim that the presence of microfinance banks in the market may even put pressure on social-driven microfinance institutions to reduce interest rates and agency costs, and increase efficiency

According to our model, the emergence of bank microcredit always results in a higher degree of participation in the credit market, provided that adverse selection is not too extreme, and microcredit is viable. Whether this is efficient from a value added point of view, it depends on the efficiency of the screening technologies banks are endowed with. If banks are sufficiently ineffective at screening, then the reduction in rationing associated with microcredit generates more value added in expected terms for the economy, while the opposite is true if banks are sufficiently good at screening their applicants. We test the main models' predictions, namely that financial liberalization should (i) positively affects the development of bank microcredit, and (ii) results in higher interest rates on bank microcredit –relatively to standard credit, using panel data from Colombia, a country which underwent a financial liberalization reform, in the form of relaxing interest rate ceilings, by introducing contract specific regulations. The estimated results show a significant impact of financial liberalization along the lines predicted by the model.

The rest of the paper is organized as follows. The next section presents the model. Section 3 characterizes the equilibrium. Section 4 discusses the model's implications for financial repression. Section 5 presents the empirical evidence for Colombia. Section 6 concludes.

2 The Model

We consider a competitive credit market populated by a large number F of borrowers and a large number B of banks. All agents are risk-neutral. Each bank is endowed with one unit of financial resources. Each borrower is endowed with a project that needs one unit of finance and delivers R if the borrower is successful and zero otherwise. Banks' opportunity cost is γ. We consider the case in which, $B/F > 1$, so that there is abundancy of financial resources.

Banks offer lending contracts characterized by a cost of credit r and an amount t of application processing time, so that a contract is generally defined as $C = \{r, t\}$.

Borrowers are heterogeneous along two dimensions: riskiness, ρ, and Informational transparency, τ. We have risky (R) and safe (S) borrowers –so that $\rho = (R, S)$, opaque (O), and transparent (T) ones –so that $\tau = (O, T)$. Correspondingly, borrower's type is identified by, $\theta = (\rho, \tau)$.

Borrowers' type is decided by nature: ρ equals S with probability π and R with probability $1 - \pi$, while τ equals T with probability λ and O with probability $1 - \lambda$. The payoff of a financed borrower of type θ as a function of a lending contract $C = \{r, t\}$, where r is the cost of credit, and t is the amount of time that the lender takes to process the loan application is

$$\beta^t(R - r) \tag{1}$$

in present value terms in case of success, and zero otherwise. We assume that borrowers of type R have a lower probability of success than those of type S: $p_R < p_S$. Accordingly the expected payoff for a financed borrower of riskiness ρ is

$$p_\rho \beta^t (R - r) \tag{2}$$

Banks can acquire an informative signal $s = R, S$ about the true riskiness of a perspective borrower at a cost $c > 0$. The signal s has the following probabilistic structure. Given the true riskiness, ρ, of a borrower, the signal s is correct, i.e. $s = \rho$, with probability $\sigma_{\rho,\rho}$ and wrong, i.e. $s \neq \rho$, with probability $1 - \sigma_{\rho,\rho}$, where $\sigma_{\rho,\rho}$ is assumed to be an increasing function of t: The longer the bank takes to process a loan application, the more time the bank has got to acquire information about the borrower, which results in a better signal. We assume that acquiring a signal requires more time in the case of opaque borrowers as opposed to the case of transparent ones. Accordingly, we specify banks' screening technology as follows:

$$\sigma_{\rho\rho} = \begin{cases} \overline{\sigma} & \text{if } t \geq t_\tau \\ \underline{\sigma} & \text{if } t < t_\tau \end{cases} \tag{3}$$

where $t_T < t_O$. Note that having observed a signal $s = S$, the conditional probability that the borrower is S is:

$$Pr(\rho = S | s = S) = \frac{\pi \sigma_{SS}}{\pi \sigma_{SS} + (1 - \pi)\sigma_{SR}} \tag{4}$$

Similarly, having observed a signal $s = R$, the conditional probability that the borrower is R is:

$$Pr(\rho = R | s = R) = \frac{(1 - \pi)\sigma_{RR}}{(1 - \pi)\sigma_{RR} + \pi \sigma_{RS}} \tag{5}$$

The signal is informative if:

$$Pr(\rho | s = \rho) > Pr(\rho) \tag{6}$$

where $Pr(\rho)$ is the unconditional probability that borrower's riskiness is ρ, with $Pr(\rho = S) = \pi$. Accordingly, given symmetry, i.e. $\sigma_{RS} = \sigma_{SR}$, and $\sigma_{SS} = \sigma_{RR}$, a signal is informative, i.e. $Pr(\rho | s = \rho) > Pr(\rho)$, if

$$\sigma_{\rho\rho} > \frac{1}{2} \qquad \rho = S, R \tag{7}$$

Note also that the signal is mis-informative, i.e. $Pr(\rho = j | s = j) < P(\rho)$, $j = S, R$, if:

$$\sigma_{\rho\rho} < \frac{1}{2} \qquad \rho = S, R \tag{8}$$

Finally, the signal is uninformative if

$$\sigma_{\rho\rho} = \frac{1}{2} \qquad \rho = S, R \tag{9}$$

Given the above, we assume that

$$\overline{\sigma} > \frac{1}{2} \tag{10}$$

$$\underline{\sigma} = \frac{1}{2} \tag{11}$$

Finally, we assume adverse selection, in that only borrowers' of type S are worth financing: $p_S R > \gamma > p_R R$.

Given perspective borrower's transparency, we call bank microcredit (M), a loan contract C characterized by a waiting time lower than t_τ. Similarly, we bank credit (B), a loan contract C characterized by a waiting time greater or equal than t_τ.

2.1 Bank's expected profits

Given a gross interest rate on leding r, the expected profits of a bank that only offers credit, conditional on a positive signal, $s = S$, are given by $u_B \equiv p_B r - c$, where

$$p_B \equiv \frac{\pi\overline{\sigma}}{\pi\overline{\sigma} + (1-\pi)(1-\overline{\sigma})} p_S + \frac{(1-\pi)(1-\overline{\sigma})}{\pi\overline{\sigma} + (1-\pi)(1-\overline{\sigma})} p_R \tag{12}$$

is the probability of repayments on bank loans. We assume that the screening technology is strictly profitable in the sense that $p_B R - c > \gamma$.

The expected profits of a bank that offers microcredit, i.e does not acquire meaningful signals about borrowers' riskiness is given by $u_M \equiv p_M r$, where

$$p_M \equiv \pi p_S + (1-\pi) p_R \tag{13}$$

is the probability of repayments on microcredit. We assume $p_M R > \gamma$ so that there exist values of r such that a microcredit is profitable to banks. Note that, for any given r, $u_B > u_M$ holds for c small enough, since $\overline{\sigma} > 0.5$ and $p_R < p_S$.

Note that, since waiting is costly for borrowers, either a bank offers microcredit, in which case lending is not conditional on signal, or if a bank offers loans contracts characterized by a waiting time greater or equal to t_τ, then the bank undertakes screening and it will lend only to borrowers for which the resulting signal is positive. That is, in equilibrium, lending conditional on a negative signal is ruled out.

2.2 Sorting conditions

Lemma 1 (Sorting Condition)**.** *Let $C_M \equiv \{r_1, t_1\}$ and $C_B \equiv \{r_2, t_2\}$ a pair of bank credit and microcredit contracts, with $t_1 < t_2$. Then, other things equal, if a risky borrower prefers C_B over C_M then, a safe borrower strictly prefers C_B to C_M.*

Proof. See appendix.

2.3 Timing and equilibrium concept

An equilibrium in the credit market is pure strategy subgame perfect Nash equilibria (SPNE) of the following game:

Stage 1: Banks simultaneously announce contracts;

Stage 2: Borrowers choose whether to borrow or not and according to which contract;

Stage 3: Banks decide whether to accept or reject each individual loan application they receive (probably the same as widthdraw the contract);

Stage 4: Exchange, if any, takes place.

In our analysis, we restrict our attention to robust SPNE.

Definition 1 (Equilibrium)**.** An equilibrium is a set of a set of strategies for borrowers and lenders and a system of beliefs such that: 1. Agents' strategies are best reply given other at each stage of the game; 2. Beliefs are derived using Bayes's rule whenever possible.

3 Laissez faire Economy

Preliminary results

Lemma 2 (Monotonicity)**.** *Let $\mathcal{C}^E$ the set of contracts played with positive probability in a given equilibrium E. Consider two contracts, $C' = \{r', t'\}$, $C'' = \{r'', t''\}$, with $C' \neq C''$. Then, if $C', C'' \in \mathcal{C}_E$, $r' > (<)[=]r''$ implies $t' < (>)[=]t''$.*

Proof. The proof follows immediately from the fact that agents' payoff is strictly decreasing both in r and t.

The following result about separation between risky and safe types holds.

Lemma 3 (No separation according to risk)**.** *There is no equilibrium in which safe borrowers separate.*

Proof. See appendix.

In a separating equilibrium where all risky borrowers are separated from safe ones, risky borrowers would be unable to borrow as their projects have have a negative expected net present value. Differently, as competition drives banks' profits to zero, safe borrowers would be able to borrow at a cost such that they make strictly positive expected profits. But then, risky borrowers would have an incentive to mimic safe ones, which implies that separation between risky and safe borrowers is never an equilibrium. Similarly, in an equilibrium where some of the safe borrowers separate from the rest by applying for loans subject to screening, incurring the screening cost is not a subgame perfect equilibrium strategy for banks: since only safe borrowers are applying for bank loans, banks best reply is not to screen applicants, which destroys the candidate equilibrium, as some of the risky borrowers would then have the incentive to mimic safe ones and apply for such loans.

3.1 Equilibrium characterization

Given lemma 3, the equilibrium candidates are: (a) "Separating equilibria" which transparent borrowers go for bank credit and opaque ones go for bank microcredit; (b) "Pooling equilibria" where all borrowers demand either credit or microcredit. We analyze separating equilibria first.

a. Separating equilibria (SE). Define, two critical values for $\alpha \equiv \beta^{-1}$,

$$\overline{\alpha} \equiv \left[\frac{(1-\overline{\sigma})(R-r_B)}{(R-r_M)}\right]^{\frac{1}{t_T}} \tag{14}$$

$$\underline{\alpha} \equiv \left[\frac{\overline{\sigma}(R-r_B)}{(R-r_M)}\right]^{\frac{1}{t_O}}. \tag{15}$$

where,

$$r_B = \frac{[\gamma + c]}{p_B} \tag{16}$$

and

$$r_M = \frac{\gamma}{p_M}. \tag{17}$$

The following result applies to the case of SE

Lemma 4. *The SE if it exists is unique: i. All transparent borrowers demand bank credit according to the contract, $C_B = \{\frac{\gamma+c}{p_B}, t_T\}$; ii. All opaque borrowers demand bank microcredit, $C_M = \{\frac{\gamma}{p_M}, 0\}$; iv. Rationing only takes place in the bank credit market. The fraction of rationed borrowers is $\lambda[(1-\pi)\overline{\sigma} + \pi(1-\overline{\sigma})]$. Necessary conditions for the existence are $R > \gamma/p_M$, $R > (\gamma+c)/p_B$, $\overline{\alpha} \geq \underline{\alpha}$, and $\alpha \in [\underline{\alpha}, \overline{\alpha}]$.* □

Proof. See appendix.

b. Pooling equilibrium (PE). The following result holds,

Lemma 5. *Any PE with financial exchange, when it exists, is characterized as follows. 1) If $\alpha < \underline{\alpha}$ all borrowers demand bank credit: i. The bank credit contract is $C_{BT} = \{\frac{\gamma+c}{p_B}, t_T\}$ for transparent borrowers and $C_{BO} = \{\frac{\gamma+c}{p_B}, t_O\}$ for the opaque ones; ii. The fraction of rationed borrowers is $[(1-\pi)\overline{\sigma} + \pi(1-\overline{\sigma})]$. 2) If $\alpha \geq \overline{\alpha}$, all borrowers demand bank microcredit; i. the microcredit contract is $C_M = \{\frac{\gamma}{p_M}, 0\}$* and all borrowers are financed. Necessary conditions for existence are $R > \gamma/p_M$, $R > (\gamma+c)/p_B$, $\alpha \geq \overline{\alpha}$ *or* $\alpha \leq \underline{\alpha}$.

Proof. See appendix.

Prevailing equilibrium. Having characterized separating and pooling equilibria we can now analyze what equilibrium prevails depending on the values of parameters. We restrict our attention to parameter configuration such that: 1. Exchange takes place; 2. Screening is a viable activity, and, 3. No rationing occurs under microcredit.

Proposition 1. *Existence and characterization of the equilibrium of the credit market are as follows: 1) If* $\alpha \in (\underline{\alpha}, \overline{\alpha})$ *a unique SE emerges such that opaque borrowers go for bank microcredit and transparent ones go for bank credit. If 2)* $\alpha \notin (\underline{\alpha}, \overline{\alpha})$*, a unique PE emerges, such that, if* $\alpha > \overline{\alpha}$ *all borrowers go for bank microcredit, and if* $\alpha < \underline{\alpha}$ *all borrowers go for bank credit. If* $\alpha = \underline{\alpha}$*, or* $\alpha = \overline{\alpha}$ *then SE and PE coexist.*

Proof. See appendix.

According to the above proposition, assuming agents are patient enough, that is $\alpha \leq \overline{\alpha}$, either a PE prevails in which banks only offer standard credit, so that all borrowers undergo a screening process, and face a positive probability of being rationed, or a SE, in which only transparent borrowers are subject to screening and are rationed with some probability, while all opaque borrowers are offered microcredit contracts, characterized by no waiting time and, accordingly, no screening. Whether the efficient equilibrium from a social point of view is the PE or the SE, it depends. Given lemmata 4-5, the following result hold,

Proposition 2. *Given* $\alpha < \underline{\alpha}$*, the prevailing equilibrium, which is characterized by bank credit, is efficient, if and only if* $\alpha < \overline{\alpha}$, if $\pi(1-\overline{\sigma})L(p_S R - \gamma) \leq L(1-\pi)\overline{\sigma}(\gamma - p_R R)$, and it is inefficient otherwise. Given $\alpha \in (\underline{\alpha}, \overline{\alpha})$ *, the prevailing equilibrium, which is SE is efficient if* $\pi(1-\overline{\sigma})L(p_S R-\gamma) > L(1-\pi)\overline{\sigma}(\gamma - p_R R)$, and it is inefficient otherwise.

Lemma 6. *Proof.* See appendix.

The intution behind the result in proposition (2) is as follows. In a PE equilibrium, where banks offer standard credit, a mass, $L\pi(1-\overline{\sigma})$, of safe potential borrowers, and a fraction At the same time, a mass $L(1-\pi)\overline{\sigma}$ of risky borrowers are not financed. Each of thes afe rationed borrowers would have generated an expected aggregated value added of $p_S R - \gamma$ if financed, while in the case of the risky rationed ones, each of them would have caused an expected loss equal to $p_R R - \gamma$ if financed. Accordingly, a PE equilibrium is efficient if the resulting loss in aggregate value added due to the rationing associated standard credit, $(p_S R - \gamma)L\pi(1-\overline{\sigma})$ is lower than the correspondent gain in aggregate value added, $(p_R R - \gamma)L(1-\pi)\overline{\sigma}$. An equivalent reasoning holds for the case of a SE.

4 Financial liberalization and emergence of microcredit

In the absence of regulation of the credit market, depending on parameter configurations, the market finds itself either in a SE or in a PE. In a SE, opaque borrowers demand microcredit finance, characterized

by a higher interest rates and lower waiting times than those associated with credit finance, which is demanded by transparent borrowers. In a PE, either all borrowers demand microcredit or the all demand bank loans, depending on parameter configurations.

Consider, now the possibility that the government imposes an interest rate ceilng, $\overline{r}$. The following result holds,

Proposition 3. *Assume* $\alpha \in (\underline{\alpha}, \overline{\alpha})$ *and* $R > \max(\gamma/p_M, (\gamma + c)/p_B)$. *If* $\gamma/p_M > \overline{r}$, $(\gamma + c)/p_B < \overline{r}$: *1. In the presence of the interest rate ceiling, the prevailing equilibrium is a PE, which is unique and characterized as follows: i. All borrowers demand bank credit; iii. The credit contract is* $C_{BT} = \{\frac{\gamma+c}{p_B}, t_T\}$ *for transparent borrowers and* $C_{BO} = \{\frac{\gamma+c}{p_B}, t_O\}$*; iii. The fraction of rationed borrowers is* $[(1-\pi)\overline{\sigma} + \pi(1-\overline{\sigma})]$*; 2. In the absence of the interest rate ceiling, the prevailing equilibrium is a SE, in which i. All transparent borrowers demand bank credit according to the contract,* $C_B = \{\frac{\gamma+c}{p_B}, t_T\}$*; ii. All opaque borrowers demand bank microcredit, accordint to teh contract,* $C_M = \{\frac{\gamma}{p_M}, 0\}$*; iv. Rationing only takes place in the bank credit market. The mass of rationed borrowers is* $\lambda[(1-\pi)\overline{\sigma} + \pi(1-\overline{\sigma})]$.

Proof. The result immediately follows from Proposition 1: If $\alpha \in (\underline{\alpha}, \overline{\alpha})$ borrowers select a SE; and the SE is not feasible because of financial repression, then all demand bank credit, and a pooling characterized by bank credit emerges.

The above proposition says f interest rate ceilings might result in financial repression by affecting the equilibrium outcome. In particular, interest rate ceilings might prevent the development of bank microcredit. From a different perspective, financial liberalization policies according to which interest rate ceilings for usury are imposed taking into account the characteristics of each particular credit market, might take the credit market from a pooling equilibrium with no bank microcredit, where the opaque and impatient borrowers –who are typical customers of microcredit– are rationed, to an equilibrium where lenders offer both loan contract accessible only by transparent borrowers, and microcredit contracts to the opaque ones, who are no longer rationed.

4.1 Empirical implications

Consider an economy for which proposition 2 holds. Then, according to the model outlined above,

(a) Financial liberalization could be positively associated with the development of bank microcredit;

(b) The development of microcredit, result in a

(i) lower average waiting time

(ii) higher average cost of capital;

(iii) lower level of credit rationing (higher participation in the credit market).

5 Colombian credit market: 2004-2012

5.0.1 Bank microcredit in Colombia

Colombian commercial banks have had, until recently, a narrow presence in microcredit leaving socially-oriented not-for-profit NGOs as the almost exclusive suppliers of Colombian microcredit in the formal sector of the economy.[6] Table 2 contains the previously considered descriptive statistics on breadth, outreach, management practices and financial performance for the sample of Colombian NGO and bank MFIs surveyed by the MIX for the three three-year sub-periods of 2004-2006, 2007-2009 and 2010-2012. The main characteristical differences on approaching microfinance between NGOs and banks observable in the worldwide sample of MFIs (see Table 1) are also observable for these kinds of Colombian MFIs.[7]

Two important regime changes occurred in Colombia during the previous decade that resulted in an increased presence of the traditional banking sector in the microcredit market. The first of these being a October 2002 agreement between the Colombian government and the country's banking sector, where 31 banking institutions committed their own resources to foster the development of microcredit loans in the country, see Delfiner & Perón (2007) and Ministry of Economic Development (2002). This agreement expired in December 2006 and, considering the increase in volume of microcredit originated, had a modest impact. The second regime change occurred on December 2006,[8] when the state imposed usury law on the banking sector was amendment and, consequently, relaxed. The new legislation abolished the existing undifferentiated interest rate ceiling for all loan types, and in its place established distinct interest rate ceilings for each type of loan. Anti-usury legislation in the form of a interest rate ceiling exists in Colombia since 1971, and previous to December 2006 only allowed for the existence of a unique interest rate ceiling that delimited the upper bound of all loan types originated by financial institutions in the country. The amended Colombian anti-usury legislation effectively created an interest rate ceiling exclusive for microcredit loans originated by financial institutions that is distinct and superior from the interest ceiling that other traditional loans are subject to.

Figure 1 and Table 3 evidence the structural changes observed in the Colombian credit markets following the financial liberalization of December 2006. The source of the data is the Colombian Financial Superintendency. The left and right panels in Figure 1 depict the average monthly interest rates charged

[6] See USAID () for a comprehensive survey of the role on microcredit of the mostly predatory Colombian informal financial sector.

[7] The Colombian bank MFIs included in the MIX sample for the 2004-2006 period are Banco WWB and Banco Caja Social BCSC, and for the 2007-2009 and the 2010-2012 periods are Bancamia, Banco WWB, Bancolombia-Microfinanzas, Banco Caja Social BCSC and ProCredit.

[8] Reference: Decreed 3078 of September 8, 2006.

Table 2: Descriptive statistics on Colombian NGO and Bank MFIs

Variables	MFI type	2004-2006	2007-2009	2010-2012
Total Microlenders	NGO	12	20	19
	Bank	2	5	5
For Profit	NGO	0%	0%	0%
	Bank	100%	100%	100%
Regulated	NGO	0%	0%	0%
	Bank	100%	100%	100%
Age	NGO	100% 0% 0%	90% 5% 5%	90% 5% 5%
{Mature Young New}	Bank	100% 0% 0%	33% 17% 50%	29% 43% 29%
Outreach	NGO	29% 36% 36%	54% 21% 25%	65% 15% 20%
{Small Med Large}	Bank	0% 0% 100%	17% 33% 50%	20% 0% 80%
Target Market	NGO	0% 0% 43% 57%	0% 0% 48% 52%	0% 0% 45% 55%
{SmBus Hi Broad Lo}	Bank	0% 0% 100% 0%	0% 0% 71% 29%	0% 17% 67% 17%
% Female Borrowers	NGO	70.60%	67.90%	64.18%
	Bank	46.47%	41.97%	62.13%
Loans / Loan Officer	NGO	456	464	367
	Bank	215	509	406
Loan Portfolio	NGO	$16,374,946	$27,563,911	$42,414,156
	Bank	$637,606,753	$559,829,258	$965,361,889
Assets	NGO	$43,974,181	$120,975,710	$276,178,751
	Bank	$2,043,313,754	$2,709,839,914	$3,974,918,779
Borrowers	NGO	67,213	153,373	290,820
	Bank	518,009	765,171	541,165
Loan Loss Rate	NGO	0.55%	1.48%	1.56%
	Bank	0.05%	3.64%	2.24%
Loan Size	NGO	$600	$811	$966
	Bank	$2,441	$2,493	$4,502
Cost per Loan	NGO	$77	$101	$168
	Bank	$380	$313	$517
Lending Rate	NGO	24.40%	23.66%	32.75%
	Bank	12.79%	13.89%	15.83%
Self Sufficiency	NGO			
	Bank			

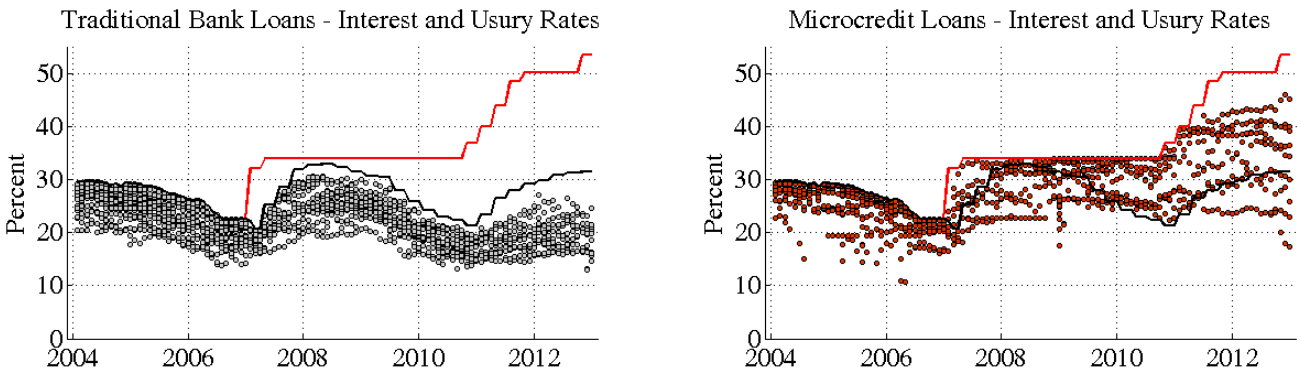

Figure 1: **Average monthly interest rates levied by Colombian banking institutions for commercial (left) and microcredit (right) loans from 2004:01 to 2012:12, and the historical usury rates on these types of loans as established by the Colombian banking authorities. Black line for interest rate ceiling of commercial loans and red for microcredit. Source: Colombian Financial Superintendency.**

Table 3: Descriptive statistics of Colombian standard and microcredit loans

Variables	**Loan type**	**2004-2006**	**2007-2009**	**2010-2012**
Interest Rates	Cons	23.7%	23.7%	18.4%
	Micro	25.2%	30.2%	33.7%
Usury Rates	Cons	27.0%	29.3%	26.8%
	Micro	27.0%	33.8%	43.8%
Total New Loans	Cons	12,885	24,368	47,856
(in Millions of USD)	Micro	483	1,538	3,443

by the Colombian banking institutions for consumer and microcredit loans from 2004:01 to 2012:12, respectively. Both panels in the figure also contain the usury rates on both types of loans established by the Colombian anti-usury legislation. [9]

No statistically significant difference is discernible in the behavior of interest rates on both types of loans prior to December 2006. This changed and both time series became significantly distinct, in terms of central tendency and dispersion, with the creation of the two distinct interest rate ceilings. Table 3 presents the average interest, average usury rate and total new new loans (in millions USD) per loan type for the 2004-2006, 2007-2009 and 2010-2012 three year periods. Once a differentiation in interest

[9] In terms of average loan size, consumer and microcredit loans are fairly dissimilar. The total volumes of consumer and microcredit loans in the Colombian banking system were respectively 34.9 and 3.5 billion USD in 2012:Q3 and, according to the Colombian Superintendence of Industry and Commerce, the amounts of individual borrowers of consumer and microcredit loans for this period were 4,851,998 and 1,677,273, respectively. These aggregate statistics yield average values for consumer and microcredit loans of 7,197 and 2,062 USD.

rate ceilings between standard and microcredit loans was enacted in December 2006, the ceiling on the interest rate of microcredit loans has always exceeded that of standard loans, and microcredit lending by traditional banks has significantly surged. The respective yearly median amounts of Colombian banks offering microcredit during the 2004-2006, 2007-2009 and 2010-2012 periods are ten, eight and ten. The yearly median amounts of Colombian banks offering microcredit loans during these sub-periods at rates higher than the usury rates of standard loans (and lower than the microcredit usury rate) are zero, four and eight, respectively. The respective aggregate values in millions of USD of these microcredit loans offered at rates above standard credit usury rate are \$0, \$973, and \$3,201. These values correspond to 0%, 63% and 88% of all microcredit originated in the Colombian banking sector during these periods. This evidence is consistent with the hypothesis that the relaxation of usury rates and, with it, financial liberalization, expanded the supply of microcredit in the formal financial sector in Colombia. It is important to also note that during this period supply of standard credit also also greatly increased, although not at the same growth rate, and the country experienced a significant economic expansion.

5.1 Panel data analysis

As discussed in section 2 the model predicts that financial liberalization could (i) foster the development of microcredit; (ii) result in a higher average difference between interest rate on credit r_B and microcredit r_M. We test the above implications using a balanced panel data on the Colombian market for standard and microdedit loans originated by the country's banking sector pre- and post- the financial liberalization of December 2006. The sources of all data in the regression analyses is the Colombian Financial Superintendency and the Colombian Central Bank, and descriptive statistics of all bank level variables included in the models are included in Table 4.

Financial liberalization and the surge of microcredit. In order to asses the impact of financial liberalization on the development of microcredit we estimate the following fixed effect model:

$$m_{i,t} = \beta_1 b_i + \beta_2 FL_t + \beta_3 r_t + \vec{\beta}_4 \boldsymbol{C}_{i,t} + \epsilon_{i,t}. \tag{18}$$

Where

$$m_{i,t} = \frac{Vol_{i,t}^M}{Vol_{i,t}^B} \tag{19}$$

is the ratio between the flow of new microcredit loans being originated at time t from bank i, $Vol_{i,t}^M$, and the correspondent value for consumer standard loans, $Vol_{i,t}^B$. FL_t is a dummy variable that takes value one in the post-financial liberalization period (from 1st January 2007 onward) and zero otherwise. r_t is the Colombian interbank interest rate at time t. $\boldsymbol{C}_{i,t}$ is a set of bank i controls at time t including *Capital/Asset ratio*, *percentage of Non-Performing loans*, *Return on Assets (ROA)*, *Cash/Deposits* ratio,

Table 4: Descriptive statistics on selected Colombian Bank MFIs

Name of Bank	Variables	2004-2006	2007-2009	2010-2012
Banco de Bogota	$Vol^M_{i,t}$ / $Vol^B_{i,t}$	6.41%	8.02%	5.48%
	$r^M_{i,t} - r^B_{i,t}$	1.56%	7.24%	19.52%
	capital/assets	13.00%	12.10%	17.2%
	non-performing loans	1.82%	1.21%	0.65%
	ROA	2.71%	2.83%	2.81%
	cash/deposits	2.39%	2.65%	2.20%
	assets (in USD)	$5,094,263,851	$11,485,565,368	$21,438,065,938
Banco Popular	$Vol^M_{i,t}$ / $Vol^B_{i,t}$	0.36%	1.07%	0.32%
	$r^M_{i,t} - r^B_{i,t}$	-1.23%	-0.46%	14.54%
	capital/assets	10.04%	9.84%	12.87%
	non-performing loans	1.18%	0.73%	0.52%
	ROA	1.13%	0.97%	1.70%
	cash/deposits	4.64%	4.22%	4.42%
	assets (in USD)	$2,396,867,034	$4,431,709,964	$7,406,972,876
Bancolombia	$Vol^M_{i,t}$ / $Vol^B_{i,t}$	7.64%	7.32%	5.65%
	$r^M_{i,t} - r^B_{i,t}$	0.29%	6.59%	10.90%
	capital/assets	13.29%	14.75%	15.85%
	non-performing loans	1.70%	1.89%	1.21%
	ROA	1.19%	2.31%	-1.96%
	cash/deposits	3.49%	4.67%	4.6%
	assets (in USD)	$7,771,494,844	$16,878,118,154	$29,894,117,629
Banco Caja Social BCSC	$Vol^M_{i,t}$ / $Vol^B_{i,t}$	24.9%	54.91%	39.02%
	$r^M_{i,t} - r^B_{i,t}$	1.57%	5.54%	11.91%
	capital/assets	9.71%	8.84%	11.08%
	non-performing loans	3.77%	3.09%	3.23%
	ROA	3.19%	2.03%	1.99%
	cash/deposits	4.51%	4.86%	4.86%
	assets (in USD)	$1,386,432,012	$3,113,888,033	$4,677,467,211

and *log(Assets)*. $\epsilon_{i,t}$ is the iid error term. The time horizon is of monthly frequency extending from January 2004 to December 2012; i.e. $t = \{1, ..., 108\}$. The banks included in the regression are the four commercial banks that have consistently offered microcredit contracts in Colombian throughout the considered time horizon; there are Banco de Bogota, Banco Popular, Bancolombia and Banco Caja Social BCSC. The estimations are reported in Table 5, left column. Financial liberalization is found to have a positive and significant impact on the development of microcredit as proxied by $m_{i,t}$ as predicted by the model. All other regressors have the expected sign.

Financial libralization and cost of credit vs cost of microcredit. In order to evaluate the impact of financial liberalization on the differential between cost of credit and microcredit, we estimate the following fixed effect model:

$$r^M_{i,t} - r^B_{i,t} = \alpha_1 b_i + \alpha_2 FL_t + \alpha_3 i_t + \vec{\alpha}_4 \boldsymbol{C}_{i,t} + \epsilon_{i,t} \tag{20}$$

where $r^M_{i,t}$ and $r^B_{i,t}$ are, respectively, the interest rates on standard credit and microcredit charged by bank i at time t. Eq. (20) share the same regressors as Eq. (18). The estimation results are presented in Table 5, right column. Coherently with our model, financial liberalization has a strongly significant impact on the interest rate differential between microcredit and bank credit. All other regressors estimates have the expected sign.

6 Conclusion

We analyzed a simple competitive model of credit market characterized by adverse selection, in which borrowers are heterogeneous with respect to riskiness of their prospects and informatonal transparency, and banks have access to a screening technology that enables them to extract a signal about perspective borrowers' type by devoting enough time to process their loan applications. Crucially, the time necessary for signal extraction depends on the degree of informational transparency of the borrower. We showed that in the laissez fair economy, depending on parameter values, we could either have a pooling equilibrium where banks only offer credit conditional on screening a separating equilibrium emerge in which banks downscale their lending activity to reach opaque borrowers by offering both standard credit conditional on screening and microcredit unconditional on screening. microcredit contracts are characterized by a lower waiting time, and higher cost of credit compared to standard credit loans, which we find to be consistent with empirical evidence. The model also predicts that regulation of credit markets by interest rate ceilings can result in financial repression such that to prevent banks' downscaling into credit markets. Conversely, financial liberalization might be associated with the development of bank microcredit. Time series and panel data analyses on Colombia's credit marekt, confirm these main insights from the model. Consistently with empirical evidence. SE in which banks offer both microcredit

Table 5: Panel data estimates for Colombian bank credit market

Variables	$\mathbf{Vol^M_{i,t}}$ / $\mathbf{Vol^B_{i,t}}$	$\mathbf{r^M_{i,t} - r^B_{i,t}}$
$\mathbf{FL_t}$	3.950	1.616
	(2.1)**	(2.6)***
$\mathbf{i_t}$	0.089	-0.349
	(0.3)	(3.4)***
$\mathbf{C_{i,t}}$**: Capital/Asset**	-0.935	1.282
	(2.7)***	(11.3)***
$\mathbf{C_{i,t}}$**: Non-performing loans**	1.855	-1.367
	(1.9)*	(4.2)***
$\mathbf{C_{i,t}}$: **ROA**	-0.075	0.518
	(0.2)	(3.9)***
$\mathbf{C_{i,t}}$: **Cash/Deposits**	1.009	-0.179
	(1.1)	(0.6)
$\mathbf{C_{i,t}}$**: log(Assets)**	3.913	5.754
	(2.0)**	(8.7)***
$\mathbf{R^2}$	0.72	0.78
Time Effects	Yes	Yes
Number of Time Periods	108	108
Fixed Effects	Yes	Yes
Number of Banks	4	4

and standard credit are characterized by less credit rationing, i.e. more market participation. Whether this results in an overall gain in terms of aggregate value added being generated by the market it depends on the efficiency of the screening technology available to banks. The less effective bank's screening is, the higher the chance that downscaling into microcredit generates a net gain at aggregate level.

A Appendix

A.1 Proof of Lemma 1

If a risky borrower prefers C_B over C_M then,

$$(1-\overline{\sigma})p_R\beta^{t_2}(R-r_2) \geq p_R\beta^{t_1}(R-r_1). \tag{21}$$

But then, given $\sigma > 0.5$,

$$\overline{\sigma}p_S\beta^{t_2}(R-r_2) > p_S\beta^{t_1}(R-r_1) \tag{22}$$

holds. That is, safe borrowers strictly prefer C_B over C_M.□

A.2 Proof of Lemma 3

Consider a separating equilibrium where all safe borrowers separate from risky borrowers. Safe borrowers demand credit subject to screening and risky ones demand microcredit. Banks' zero profits' condition implies that the cost of credit for risky types exceeds the gross return R. Hence, risky types would not be able to borrow and would therefore earn zero profits. Also, banks' zero profits condition implies that hte cost of credit for safe types is strictly lower than the gross return R, so that safe types would be able to borrow and therefore would earn a strictly positive payoff. But then, risky types have always an incentive to mimic safe types.

Consider now an equilibrium in which some of the safe (for instance the patient ones, who are more willing to wait) separate from the risky, by demanding credit subject to screening. Then, bankers supplying such loans would find it profitable to deviate and not incur the screening cost. But then, risky and patient will find it convenient to deviate and demand such loans which destroys the candidate equilibrium.

A.3 Proof of Lemma 4

First we characterize the TSE. and then discuss existence.

i. Processing time. In any TSE, the processing time associated with bank credit contracts signed by borrower of transparency τ must satisfy, $t_B = t_\tau$, while irrespectively of transparency, microcredit contracts must satisfy, $t_M = 0$. The proof is immediate. Consider an TSE equilibrium in which $t > t_\tau$

for some τ. Then, since t_τ is the amount of time that banks need in order to screen applicants of transparency, τ, a bank could attract all transparent borrowers and make strictly positive profits by offering a contract characterized by a slightly higher cost of credit and a lower processing time, which destroys the candidate equilibrium. An equivalent argument can be put forward to conclude that $t_M = 0$.

ii. Participation and incentive compatibility constraints. Banks' participation constraints (PCs) are described by the following,

$$(PC_i) : p_i r_i \geq \gamma$$

where $i = B$ for bank credit, and $i = M$ for bank microcredit. As for borrowers,

$$\alpha^{-t} p_\rho \mu (R - r_B) \geq 0. \tag{23}$$

is the participation constraint for a borrower of riskiness ρ when applying for bank credit, with $t = t_O, t_T$, depending whether the borrower is opaque or transparent, and μ is the probability to access credit, which equals $\overline{\sigma}$ for safe borrowers and $1 - \overline{\sigma}$ for risky ones. The PC for borrowers of riskiness ρ applying for microcredit is

$$p_\rho (R - r_M) \geq 0. \tag{24}$$

Borrowers' incentive compatibility constraints are:

$$(ICC_{TS}) \quad : \quad \alpha^{-t_T} \overline{\sigma} p_S (R - r_B) \geq p_S (R - r_M) \tag{25}$$

$$(ICC_{TR}) \quad : \quad \alpha^{-t_T} (1 - \overline{\sigma}) p_R (R - r_B) \geq p_R (R - r_M) \tag{26}$$

$$(ICC_{OS}) \quad : \quad \alpha^{-t_O} \overline{\sigma} p_S (R - r_B) \leq p_S (R - r_M) \tag{27}$$

$$(ICC_{OR}) \quad : \quad \alpha^{-t_O} (1 - \overline{\sigma}) p_R (R - r_B) \leq p_R (R - r_M) \tag{28}$$

iii. Cost of credit. Competition among banks implies that bankss' participation constraints must be satisfied as strict equalities, so that:

$$r_B = \frac{\gamma + c}{p_B} \tag{29}$$

where,

$$p_B = \frac{\pi \overline{\sigma}}{\pi \overline{\sigma} + (1 - \pi)(1 - \overline{\sigma})} p_S + \frac{(1 - \pi)(1 - \overline{\sigma})}{\pi \overline{\sigma} + (1 - \pi)(1 - \overline{\sigma})} p_R \tag{30}$$

and

$$r_M = \frac{\gamma}{p_M} \tag{31}$$

where,

$$p_M = \pi p_S + (1-\pi)p_R. \tag{32}$$

Note that $\overline{\sigma} > 0.5$ implies $p_M < p_B$ so that $r_B < r_M$. Given $R > 0$, borrowers' participation constraints are satisfied so long as γ is sufficiently small.

iv. Existence. From the incentive compatibility constraints, we note that, given $t > 0$, the more stringent constraints are the following

$$(ICC_{PR}) \quad : \quad \alpha^{-t_T}(1-\overline{\sigma})p_R(R-r_B) \geq p_R(R-r_M) \tag{33}$$

$$(ICC_{OS}) \quad : \quad \alpha^{-t_O}\overline{\sigma}p_S(R-r_B) \leq p_S(R-r_M) \tag{34}$$

The first inequality is satisfied so long as $\alpha \leq \overline{\alpha}$, and the second inequality is satisfied if $\alpha \geq \underline{\alpha}$. Accordingly, in order for a SE where transparent are separatated by opaque, the following two conditions need to be satisfied; 1. $\overline{\alpha} > \underline{\alpha}$ must hold, which in equilibrium reduces to

$$\left\{\frac{(1-\overline{\sigma})[R-(\gamma+c)/p_B]}{(R-\gamma/p_M)}\right\}^{\frac{1}{t_T}} \geq \left\{\frac{\overline{\sigma}[R-(\gamma+c)/p_B]}{(R-\gamma/p_M)}\right\}^{\frac{1}{t_O}}, \tag{35}$$

and, 2. α must be such that $\alpha \in [\underline{\alpha}, \overline{\alpha}]$. Moreover, Note also that $\gamma/p_M < R$ and $((\gamma+c)/p_B$ must hold in order for participation constraints to be satisfied .□

A.4 Proof of lemma 5

We characterize PE in which all borrowers deman bank lcredit and PE in which all borrowers demand bank microcredit, and then study their existence.

a. PE with bank credit.

i. Processing time. The same argument as in the case of SE holds that in any PE where bank offer bank loans, $t = t_T$ for transparent borrowers, and$t = t_O$ for opaque ones.

ii. Participation and incentive compatibility constraints. Lenders' participation constraints (PCs) are described by the following,

$$(PC_B) : p_B r_B \geq \gamma$$

As for borrowers,

$$\beta^t p_R(1-\overline{\sigma})(R-r_B) \geq 0. \tag{36}$$

is the participation constraint for a borrower of riskiness R when applying for bank credit with $t = t_O, t_T$ for bank lonas, depending whether the borrower is opaque or transparent, and similarly, for a safe borrower,

$$\beta^t p_S \overline{\sigma}(R-r_B) \geq 0. \tag{37}$$

iii. Cost of credit. The probability of loan repayment is

$$p_B = \frac{\pi\overline{\sigma}}{\pi\overline{\sigma}+(1-\pi)(1-\overline{\sigma})}p_S + \frac{(1-\pi)(1-\overline{\sigma})}{\pi\overline{\sigma}+(1-\pi)(1-\overline{\sigma})}p_R. \tag{38}$$

Competition across lenders drive their profits to zero, which implies

$$r_B = \frac{\gamma + c}{p_B}. \tag{39}$$

iv. Necessary conditions for existence Borrowers participation constraints are satisfied so long as $R \geq r_B$ holds. Hence, the necessary condition for the existence of a PE with banking contracts, is $R \geq (\gamma + c)/p_B$.

v. PE with microcredit.

i. Cost of credit and processing time. In a pooling with microcredit, processing time equals zero. Banks do not extract any meaningful signal. Therefore, Therefore, the probability of loan repayment is

$$p_M = \pi p_S + (1-\pi)p_R. \tag{40}$$

so that, competition among lenders, yields

$$r_M = \frac{\gamma}{p_M}. \tag{41}$$

ii. Necessary condition for existence: Borrowers' participation constraint. Borrowers participation constraints are satisfied so long as $R \geq r_M$ holds. Hence, a necessary condition for existence is $R \geq \gamma/p_M$.

iii. Necessary conditions for existence: Microcredit vs Credit. Opaque and risky borrowers have the lower expected payoff if applying for banking contracts, which amounts to $(1-\sigma)\beta^{t_O}p_R(R-r_B)$. If a microcredit contract were available, their payoff would be, $p_R(R-r_M)$. Hence, if $(1-\sigma)\beta^{t_O}p_R(R-r_B) > p_R(R-r_M)$, i.e. if $\alpha < \underline{\alpha}$ all borrowers prefer banking contracts to microcredit contracts. Safe and transparent borrowers have the highest expected payoff if applying for banking contracts, which amounts to $\sigma\beta^{t_T}p_S(R-r_B)$. If a microcredit contract were available they would earn $p_S(R-r_M)$ so that if $\sigma\beta^{t_T}p_S(R-r_B) < p_S(R-r_M)$, that is $\alpha > \overline{\alpha}$ all borrowers prefer the microcredit contract.

A.5 Proof of Proposition 1

Consider a pooling, with bank credit subject to screening. Consider a deviation $C_M^+ = \{0, \gamma/p_M + \epsilon\}$, with $\epsilon \to 0^+$ by a lender. So long as,

$$\alpha^{-t_O}p_S\overline{\sigma}(R - \frac{\gamma + c}{p_B}) < p_s(R - \frac{\gamma}{p_M}). \tag{42}$$

such deviation would attract safe and opaque borrowers and it will be profitable given the pool of applicants (which is going to include all borrowers, since no lending occurs at the old contract in equilibrium, since the pool of applicants for that contract must have worsened given that safe and opaque go for the new contract. The above inequality reduces $\alpha > \underline{\alpha}$. Hence a PE with bank contracts never exists if $\alpha > \underline{\alpha}$, and it exists otherwise. Similarly, consider a PE with microcredit contracts. Consider a deviation, $C_B^+ = \{t_T, (\gamma + c)/p_B + \epsilon)\}$, where $\epsilon \to 0^+$. So long as,

$$\alpha^{-t_T}\overline{\sigma}p_S(R - \frac{c + \gamma}{p_B}) \geq p_S(R - \frac{\gamma}{p_M}), \tag{43}$$

then safe and transparent borrowers would be attracted such deviation. Moreover, given the pool of applicants, the deviation is profitable (Note that all borrowers go for this contract since nobody offers loans at the old contract in the subgame since the pool has worsened). The deviation would not be profitable if transparent and safe are not attracted. The above inequality reduces to $\alpha < \overline{\alpha}$.

Consider now a separating equilibrium. Consider a deviation $C_M^+ = \{0, \gamma/p_M + \epsilon\}$. So long as

$$\alpha^{-t_T}p_S\overline{\sigma}(R - \frac{\gamma + c}{p_B}) < p_s(R - \frac{\gamma}{p_M}). \tag{44}$$

the above deviation would be strictly profitable, where the above inequality reduces to $\alpha > \overline{\alpha}$. Consider now an alternative deviation $C_B^+ = \{t_O, (\gamma + c)/p_B + \epsilon)\}$. So long as,

$$\alpha^{-t_O}p_S\overline{\sigma}(R - \frac{\gamma + c}{p_B}) > p_s(R - \frac{\gamma}{p_M}). \tag{45}$$

such deviation would be strictly profitable, where the above inequality reduces to $\alpha < \underline{\alpha}$.

A.6 Proof of proposition 2

In a PE, the expected future net value generated by the credit market through financial exchange is,

$$FNV_{PE} = \pi\overline{\sigma}(p_s R - \gamma) + (1-\pi)(1-\overline{\sigma})(p_R R - \gamma) \tag{46}$$

while for the SE the correspondent value is,

$$FNV_{SE} = (1-\lambda)[\pi(p_S R - \gamma) + (1-\pi)(p_R R - \gamma)] + \lambda FNV_{PE} \tag{47}$$

. Hence, the most efficient equilibrium would be PE if and only if

$$\pi\overline{\sigma}(p_s R-\gamma)+(1-\pi)(1-\overline{\sigma})(p_R R-\gamma) \geq (1-\lambda)[\pi(p_S R-\gamma)+(1-\pi)(p_R R-\gamma)]+\lambda\{\pi\overline{\sigma}(p_s \text{R-}\gamma)+(1\text{-}\pi)(1\text{-}\overline{\sigma})(p_R \text{R-}\gamma)\} \tag{48}$$

which reduces to

$$L\pi(1-\overline{\sigma})(p_S R - \gamma) \leq L(1-\pi)\overline{\sigma}(\gamma - p_R R) \tag{49}$$

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Data Appendix

Table 1 and Table 2

The source of data on both tables is the Microfinance Information Exchange (MIX). **Total Microlenders** are the total amounts of unique NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods. **For Profit** are the percentages of for-profit NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. **Regulated** are the percentages of regulated NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. **Age** are the percentages of "Mature", "Young" and "New" NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods. **Outreach** are the percentages of NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods whose outreach are classified as "Small", "Medium" or "Large" for which this data is available. **Target Market** are the percentages of NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods whose target market are "Small Business", "High", "Broad" or "Low" for which this data is available. **% Female Borrowers** are the percentages of female borrowers of the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. **Loans / Loan Officers** are the average amount of loans per loan officers in the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. **Loan Portfolio** are the average amount of the loan portfolio of the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. **Assets** are the average amount of the assets of the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. **Borrowers** are the average amount of borrowers of the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. **Loan Loss Rate** is the average loan loss rate of the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. **Loan Size** is the average loan size of the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. **Cost per Loan** is the average cost for a borrower to obtain a loan from the NGO and Bank MFIs surveyed by MIX offering microcredit during the three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. **Lending Rate** is the average real yield of the gross loan portfolio of the NGO and Bank MFIs surveyed by MIX offering microcredit during the

three considered three-year periods for which this data is available. The averages are weighted by the loan portfolio of each bank. Note: the real yield of the gross loan portfolio is used as a proxy for the lending rate following Cull, Demirgüç-Kunt and Morduch (2007).

Table 3

Interest Rates are the weighted averages of the interest rates charged by Colombian banking instituions for consumer and microcredit loans for the three considered three-years periods. Averages are weighted by the volume of credit type by each institution. The source of data is the Colombian Central Bank, and available at http://www.banrep.gov.co/es/economia/tasas_colo4.htm. **Usury Rates** are the interested ceilings for consumer and microcredit loans during the three considered three-years periods as determined by the Colombian Financial Superintendency. The source of data is the Colombian Financial Superintendency, and available at https://www.superfinanciera.gov.co/descargas?com=institucional&name=pubFile10948&downloadname=historicousura.xls. **Total New Loans** are the averages in millions of USD of credit supplied by Colombian banking instituions for consumer and microcredit loans for the three considered three-years periods. The source of data is the Colombian Central Bank, and available at http://www.banrep.gov.co/es/economia/tasas_colo4.htm. The data is available expressed in Colombian pesos, this was converted to USD using the exchange rate provided by the Colombian Central Bank, available at http://www.banrep.gov.co/es/trm.

Table 4 and Table 5

$Vol^M_{i,t}$ / $Vol^B_{i,t}$ are the averages of the monthly ratios between new microcredit and standard consumer loans being originated by each considered Colombian bank during the three considered three-years periods. $r^M_{i,t} - r^B_{i,t}$ are the averages of the monthly differences between the interest rates on microcredit and standard consumer loans being originated by each considered Colombian bank during the three considered three-years periods. The source of data to develop these statistics is the Colombian Financial Superintendency, and is available at https://www.superfinanciera.gov.co/jsp/loader.jsf?lServicio=Publicaciones&lTipo=publicaciones&lFuncion=loadContenidoPublicacion&id=60775. **Capital/Assets** are the averages of the monthly ratios between total bank capital and total bank assets during the three considered three-years periods. The source of data to develop these statistics is the Colombian Financial Superintendency from the *Informe de Coyuntura por Entidades*, and is available at https://www.superfinanciera.gov.co/jsp/loader.jsf?lServicio=Publicaciones&lTipo= publicaciones&lFuncion=loadContenidoPublicacion&id = 60765. **Non-performing loans** are the averages of the monthly ratios of non-performing loans to total loans. The source of data to develop these statistics is the Colombian Financial Superintendency from the *Informe de Coyuntura por Entidades*, and is available at https://www.superfinanciera. gov.co/jsp/loader.jsf?lServicio=Publicaciones&lTipo= publicaciones&lFuncion=loadContenido Publicacion&id= 60765. **ROA** is the return on assets for the considered Colombian banks during the three considered three-years periods. The source of data to develop these statistics is the Colombian Financial Superintendency, and is available at https://www. superfinanciera.gov.co/jsp/loader.jsf?lServicio=Publicaciones&lTipo= pub-

licaciones&lFuncion= loadContenidoPublicacion&id=60838. **Cash/Deposits** are the averages of the monthly ratios between total bank cash and total bank deposits during the three considered three-years periods. The source of data to develop these statistics is the Colombian Financial Superintendency from the *Informe de Coyuntura por Entidades*, and is available at https://www.superfinanciera.gov.co/jsp/loader.jsf?lServicio=Publicaciones&lTipo= publicaciones&lFuncion=loadContenidoPublicacion&id= 60765. **Assets** are the averages in USD of the monthly total bank assets during the three considered three-years periods. The source of data to develop these statistics is the Colombian Financial Superintendency from the *Informe de Coyuntura por Entidades*, and is available at https://www.superfinanciera.gov.co/jsp/loader.jsf?lServicio=Publicaciones &lTipo= publicaciones&lFuncion=loadContenido Publicacion&id=60765. The data is available expressed in Colombian pesos, this was converted to USD using the exchange rate provided by the Colombian Central Bank, available at http://www.banrep.gov.co/es/trm. The **Interbank Rate** is the average value of the interbank rate for Colombian banks during the three considered three-years periods. The source of data is the Colombian Central Bank, and is available at http://www.banrep.gov.co/es/tib.