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DEVELOPMENT OF BANK MICROCREDIT

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Development of Bank Microcredit *

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Abstract

We analyze the process by which banks enter the microcredit market while still engaging in traditional credit practices. For this we study a competitive credit market with adverse selection, where lenders are endowed with a screening technology capable of extracting an informative signal about a borrower's quality if enough time is devoted to process the loan application. The time necessary for signal extraction depends on the borrower's informational transparency. In the presence of opaque and transparent borrowers, depending on economy parameters, either a separating equilibrium with standard credit or microcredit prevails or a pooling equilibrium with either loan contract prevails.

Keywords: Microcredit, Bank MFI, Asymmetric Information, Screening, Opaqueness.
Jel Classification: O16, G14, G21, G28.

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1 Introduction

This paper examines the process by which traditional banks enter the microcredit market while still engaging in standard credit practices. The last decades have been ones of important changes in the microfinance landscape, mainly due to an increasing presence of banks in this credit market -alongside and even competing with not-for-profit non-governmental organizations (NGOs) for microcredit borrowers. A bank venturing into the microcredit market typically assumes two main structures: that of a specialized microfinance institution, exclusively offering microcredit contracts to borrowers financed thru commercial capital, or of a traditional commercial bank entering the microcredit market while still primarily offering traditional banking products. The latter is commonly referred to as a "downscaling bank" and is the focus of this research.

The growing share of banks offering microcredit has contributed to the more heterogeneous contract terms and composition of borrowers now observed in this credit sector. Banks have different approaches to microcredit and social objectives from their NGO counterparts. NGO microfinance institutions (MFIs) are not-for-profit organizations generally pursuing the often conflicting objectives of financial sufficiency and poverty reduction, while bank MFIs are organized as for-profit shareholder firms, and are commercially-oriented institutions, regulated by their country's financial authorities and funded -at least partially- by commercial capital. When compared to NGO or other non-bank MFIs, banks MFIs favor individual lending over group lending, granting loans of greater volume and serving a customer base that is substantially better off.

We explore the simultaneous supply of microcredit and standard loan credit for a downscaling bank in a model of a competitive credit market characterized by adverse selection. Potential borrowers are impatient, and heterogeneous 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 ability to repay. According to such technology, the waiting time necessary to extract a meaningful signal about a borrowers' ability to repay depends on the borrowers' informational transparency. It takes less time to extract a meaningful signal from transparent borrowers than from opaque ones. We characterize the equilibrium and the existence conditions. The equilibrium in the laissez-faire economy is, whenever it exist, generally unique, and it involves either pooling or separation, depending on parameter values. In a pooling equilibrium (PE) banks offer either a standard credit contract characterized by screening or microcredit. In the first case, 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. In the second case, no rationing takes place, and loans occur at a higher interest rate. In the separating equilibrium (SE), banks offer a menu of two contracts: (i) a standard credit contract, as the one described above, which is the one preferred by transparent borrowers; and (ii) a microcredit contract, characterized by a higher cost of credit, no screening, no rationing and a lower waiting time, which is the one chosen by opaque ones. As a result, compared to the PE case, borrowers' participation on the credit market increases.

The proposed modeling environment offers an ideal setting to analyze the effects on bank microcredit of financial liberalization in the form of removal of interest ceilings. Since traditional banks are regulated financial institutions subject to their respective government limitations on financial intermediation, these organizations are often dissuaded from downscaling to microcredit in countries where anti-usury rates are present as their microcredit contracts would also be bound to the interest caps. Interest rate ceilings or anti-usury rates can then result in financial repression to the extent that they can prevent the occurrence of a SE as the one described previously. Hence, removing interest rate ceilings can foster the development of microcredit. The model thus explains the observed relationship reported in the literature between financial liberalization and the development of bank microcredit. 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, associated with an increase in the dispersion of lending interest rates.

We empirically test the main predictions of our model using two comprehensive data sets. The first of the data sets is an international cross-section of bank MFIs, and the second is a panel data from the Colombian banking sector. Colombia in January 2007 engaged in financial liberalization by relaxing interest rate ceilings and introducing microcredit-specific regulations. The volume of Colombian microcredit from bank MFIs went from a yearly average of 483 million USD during the three years prior to financial liberalization to 1,538 million during the three years immediately following liberalization, and 3,443 million during the subsequent three years. The estimated results from analyzing both data sets show a significant impact of financial liberalization along the lines predicted by the model.

To the best of our knowledge this paper represents the first attempt in the literature to model the bank downscaling and carefully characterize the equilibrium outcomes. The rest of the paper is organized as follows. The next section contains a review of the literature. Section 3 presents

the model. Section 4 characterizes the equilibrium. Section 5 discusses the model's implications regarding financial liberalization, and Section 6 presents supporting evidence using international and country-specific data. Section 7 concludes.

2 Literature Review

Microfinance institutions or MFIs assume four main organizational structures: nongovernmental organizations (NGO), cooperatives and credit unions, nonbank financial institutions (NBFIs) and commercial banking institutions (bank). NGOs are not-for-profit organizations and are not regulated by their country's financial supervision authority, while bank MFIs, NBFIs, and most coops and credit unions are for-profit regulated shareholder organizations. NGO MFIs are characterized by the often-conflicting dual mandate of poverty reduction and financial self-sufficiency, group lending practices, outreach to the poorest of borrowers, low profitability, small loan sizes and high operational costs (Snow & Buss, 2001; Cull et al., 2009; Hermes et al., 2010). The not-for-profit status of NGOs is effectively a non-distribution constraint that requires these MFIs to reinvest all profits into the organization so as to serve its social mission. Their funding comes primarily from grants and subsidies, and its absence of shareholders immunizes it from direct ownership and market pressures, (Galema et al., 2012). The unregulated status can result in weak oversight and impedes the MFI to offer a broader range of financial services like the acceptance of deposits.

In recent years, when microfinance has gain international recognition as an effective development tool, the NGO has lost preference as the primary organizational structure for MFIs. Mersland (2009) offers very complete accounts of policy papers that advocate for the preference of private ownership structures for new MFIs and even for the transformation of already existing NGO MFIs into these types of shareholder organizations. According to the global statistics for the Microfinance Information Exchange Benchmarks (MIX), which provides self-reported data for MFIs, the majority of newly created MFIs are shareholder organizations (Mersland, 2009). Furthermore, Liñares-Zegarra & Wilson (2018) calculated that the 2000-2014 growth rates of not-for-profit MFIs have shown negative persistence, while those for regulated MFIs have been positive. Consequently, while the percentage of NGOs to all MFIs was 45% in 2002-04 (Cull et al., 2009), the corresponding value for 2014-16 was 29% (Mixmarket MFI Benchmarks, various years). Arguments in favor of MFIs with a shareholder structure include the regulation and oversight by financial authorities, more efficient operations, attraction of private capital and independence from donors, and superior corporate governance. On the latter, Galema et al. (2012) found that

the governance structure in NGO MFIs has permitted their executives more decisional freedom than their peers at for-profit MFIs which has likely led to the well-documented increases in risk exposure and lower performance of these organizations.

Banks are situated at the opposite side of NGOs in the organizational structure of MFIs. The increasing presence of banks in the market for microcredit alongside or competing with NGOs has contributed to the more heterogeneous contract terms and composition of borrowers that has been observed in this credit sector. Commercial banking has created new balances in the mission of microcredit combining two previously considered separate institutional logics, i.e. a development logic guided towards helping the poor and a banking logic requiring profits to support operations (Battilana & Dorado, 2010). Considering that bank MFIs focus predominantly on ownership pressures, their financial structure and public regulations, a number of microfinance promoters and practitioners have expressed concerns about the growing commercialization of microcredit and an inevitable primary focus on profitability over poverty reduction of bank MFIs (Mersland, 2009; Copestake, 2007). However, commercial capital in microfinance is seen by its proponents as a necessary and more efficient supplier of credit to the unbanked. Hermes & Lensink (2011) further claim that the presence of microfinance banks in the market may even put pressure on socially motivated microfinance institutions to reduce interest rates and agency costs, and increase efficiency.

Two broad general structures characterize bank MFIs. These are either specialized microfinance institutions that exclusively offer microcredit contracts to borrowers financed thru commercial capital, or traditional commercial banks that entered the microcredit market while still primarily offering traditional banking products. The latter category is commonly referred to as "downscaling banks". The interest of traditional commercial banks in the microfinance market lies in the expected profitability of microcredit loans, the imposition of regulatory mandates in a country requiring microcredit lending by the commercial banking sector, the opportunity for the bank to show its corporate social responsibility, and the loss of clients for traditional banking services to bigger international banks (Schicks, 2007; Hermes & Lensink, 2011). When compared to NGOs, bank MFIs favor individual lending over group lending, grant loans of greater volume and serve a customer base that is substantially better off (Cull, et al., 2009).[1]

[1]Individual and group lending methods are important aspects that also distinguish bank and NGO MFIs. This is evident using data for all bank and NGO MFIs surveyed by MIX for their 2009 MFI Benchmarks publication. This document covers over 85% of known microfinance borrowers, and provides information on the distribution among lending methodologies adopted by these MFIs. The lending methodologies identified are (i) individual (1 borrower), (ii) solidarity (3-9 borrowers), (iii) village banking ($\geq$10 borrowers), and (iv) individual/solidarity (where loans are offered by the MFI thru individual and solidarity lending, or individual, solidarity and village banking). Data on lending methodologies is available for 64 of the total of 76 bank MFIs surveyed by MIX and for 430 of the 445 NGO MFIs. Of this 64 bank MFIs, 38 (or 59%) employ individual-lending practices; compared

Screening procedures typical of traditional banking practices are of limited effectiveness when applied to the opaque or unbanked population of prospective borrowers that typically pursue microcredit. Applying the techniques practiced by NGO MFIs to overcome the asymmetric information on this sector of the credit market would significantly increase a traditional bank's costs to a level that it would be unprofitable to issue uncollateralized standard credit loans (Snow & Buss, 2001). On this, when comparing the operational costs between MFI organizations, Mersland (2009) discusses how the costs related to overcoming the asymmetric information between a lender and the borrower are far greater for a bank MFI than for the NGO. The historical response of traditional banks on this environment has been the rationing of credit to opaque prospective borrowers. The relative small capacity of the non-profit MFI sector and the difficulties encountered by the for-profit sector to overcome asymmetric information offers too limited possibilities of accessing credit for informational opaque borrowers, which strengthens their dependence on the informal finance sector. Petersen & Rajan (1994), Morduch (2000), Berger et al. (2001), Clarke, et al. (2005), and Presbitero & Rabellotti (2013) further discuss on the ineffectiveness of standard commercial bank practices when addressing opaque and unbanked borrowers, and Chandavarkar (1992) contains a discussion on how this situation further affects unbanked borrowers' reliance on informal finance. Even when the effective screening of an information opaque borrower is possible, the extensive time it takes for a traditional bank to conduct such screening could represent a true barrier for borrowers to access financial services. Using a comprehensive worldwide survey of banks and financial services, Beck, et al. (2008) finds that the time for processing bank loans is highly correlated with outreach measures constituting a genuine hurdle for potential borrowers accessing formal financial services.

To operate as MFIs, commercial banks perform organizational adjustments intended to more efficiently originate and service debt for informational 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. CGAP (2005) reviews different general methods followed by banks that have successfully entered microcredit markets. Snow & Buss (2001) for African countries, and Westley (2006) and Prior & Argandoña (2009) for Latin America offer very complete accounts and examples on ways traditional banks have downscaled into microcredit. Of specific relevance to our research are bank MFIs that address the costly screening of potential borrowers for loans with no collateral by implementing a lending technology that involves minimum to none screening. Van Tassel (2002) and Navajas, et al. (2003) cite the case Bancosol. Organized as a regulated bank MFI since 1992 in Bolivia, Bancosol is the first

to 120 of 430 (or 28%) for the NGO MFIs.

private microfinance bank in Latin America (Lal & Lobb, 2016), and offers uncollateralized loans to unbanked or opaque borrowers with no screening. Van Tassel (2002) and Navajas, et al. (2003) highlight the effects on competition in this market characterized by extreme levels of asymmetric information and potentially costly screening, and the need for banks to adapt to the loss of market power due to the entry of additional lenders in market. Our research distances from these works as we are mainly focused in the equilibrium conditions by which a traditional bank institution downscales and offers both credit products, i.e. microcredit and standard credit loan, while the authors focus in the competing MFIs offering distinct credit products.

A final area our research is related to is financial liberalization and its role in the development of bank microcredit. Examples of financial sector regulations that can determine the level of a country's liberalization include minimum loan requirements, interest rate controls, entry barriers, state ownership of banks, and prudential regulations (Abaid, et al., 2010). Traditional banks are often dissuaded from downscaling to microcredit in markets where anti-usury rates or interest rate controls are present. Since these organizations are subject to the regulations on financial intermediation by their respective governments, their microcredit contracts are also bound to the interest caps determined by the anti-usury rates. NGO MFIs are not subject to these restrictions. Financial repression and, with it, credit rationing resulting from the enactment of anti-usury laws is well-established in the literature. A non-exhaustive list of works include Stiglitz & Weiss (1981), McKinnon (1989), Chandavarkar (1992), Homer & Sylla (1996), and Dehejia et al. (2005). On interest rate controls and bank MFIs, Jansson, et al. (2004) remarks on the counterproductive effect usury-rates have on microfinance as these loans are characterized by a higher rate and a cap on interests would only limit bank MFIs to recover their costs. Demirgüç-Kunt (2012) addresses the negative impact anti-usury rates have on the access to credit specifically on the very poor.

3 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 resource. 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 abundance 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, such that $\rho = R, S$, and opaque (O) and transparent (T) ones, so that $\tau = O, T$. Correspondingly, borrower's type is identified by a pair, $\theta = (\rho, \tau)$. Borrowers' type is private information and 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 $1 - \lambda$. Borrowers of type R have a lower probability of success than those of type S: $p_R < p_S$. We assume adverse selection in that only borrowers of type S are worth financing: $p_S R > 1 + \gamma > p_R R$.

The payoff of a financed borrower of type θ as a function of a lending contract $C = \{r, t\}$ is

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

in present value terms in case of success, and zero otherwise, where $\beta < 1$ is a continuous time subjective discount factor that captures borrowers' impatience. Accordingly the expected payoff for a financed borrower of riskiness ρ is

$$p_\rho \beta^t[R - (1 + r)] \tag{2}$$

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 probability of a signal s is $\sigma_{\rho,s}$, with $\sigma_{\rho,S} + \sigma_{\rho,R} = 1$, so that the signal is correct, i.e. $s = \rho$, with probability $\sigma_{\rho,\rho}$ and wrong, i.e. $s \neq \rho$, with probability $1 - \sigma_{\rho,\rho}$. We assume that $\sigma_{\rho,\rho}$ is an increasing function of t. The longer the bank takes to process a loan application, the greater the time available for the bank to acquire information about the borrower, which results in a better signal. We assume that acquiring a signal requires more time for opaque borrowers than for transparent ones. More precisely, we model 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 $t_T < t_O$, $0 < \underline{\sigma} < \overline{\sigma} < 1$. Given the pool of perspective borrowers (applicants) for a given credit contract, let $Pr(S)$ and $Pr(R)$ be probabilities that the applicant is either safe (S) or risky (R) prior to the observation of the signal about the applicant, with $Pr(R) + Pr(S) = 1$. Then, the conditional probability that, having observed a signal $s = S$, the applicant's riskiness, ρ, equals S, is:

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

Similarly, having observed a signal $s = R$, the conditional probability that the borrower's riskiness

equals R is:

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

The signal s is informative if $Pr(\rho|s = \rho) > Pr(\rho)$, where $Pr(\rho)$ is the prior probability about borrower's riskiness. Accordingly, given symmetry, i.e. $\sigma_{RS} = \sigma_{SR}$, and $\sigma_{SS} = \sigma_{RR}$, a signal s is informative if $\sigma_{\rho\rho} > 0.5$, with $\rho = S, R$, and uninformative if $\sigma_{\rho\rho} = 0.5$, with $\rho = S, R$, which also implies $Pr(\rho = S|s = S) > Pr(\rho = S|s = R)$. Therefore, in equation (3), we assume that $\overline{\sigma} > 0.5$ and $\underline{\sigma} = 0.5$.

We define bank microcredit (M), a loan contract C characterized by a waiting time lower than t_τ such that whenever lending on the basis of such a contract, the bank does not acquire any informative signal about the riskiness of the perspective borrower. Similarly, we define bank standard credit (B) to be a loan contract C characterized by a waiting time greater than or equal to t_τ, so that under this contract the bank gets information about riskiness of loan applicants.

3.1 Bank's expected profits

The expected profits for a bank that offers standard credit, that is credit conditional on a positive signal, $s = S$, charging a gross interest rate $1 + r_B$ are given by

$$u_B = P_B(1 + r_B) - \frac{c}{Pr(s = S)} - (1 + \gamma) \tag{6}$$

where,

$$P_B = \frac{\overline{\sigma}Pr(S)}{\overline{\sigma}Pr(S) + (1 - \overline{\sigma})Pr(R)}p_S + \frac{(1 - \overline{\sigma})Pr(R)}{\overline{\sigma}Pr(S) + (1 - \overline{\sigma})[Pr(R)}p_R \tag{7}$$

is the conditional probability of success of the loan, and

$$Pr(s = S) = \overline{\sigma}Pr(S) + (1 - \overline{\sigma})Pr(R) \tag{8}$$

is the probability of observing a signal $s = S$.

We assume that the screening technology is viable in the sense that the net expected value generated when lending is subject to a positive signal is strictly positive, i.e.

$$P_B R - \frac{c}{Pr(s = S)} - (1 + \gamma) > 0 \tag{9}$$

Note that viability is ensured for c sufficiently small, given $p_S R > 1 + \gamma$. Furthermore, we also

assume that lending subject to a negative signal is never profitable, that is

$$\left[\frac{\overline{\sigma}Pr(R)}{\overline{\sigma}Pr(R)+(1-\overline{\sigma})Pr(S)}p_R+\frac{(1-\overline{\sigma})Pr(S)}{\overline{\sigma}Pr(R)+(1-\overline{\sigma})Pr(S)}p_S\right]R<1+\gamma \tag{10}$$

Note that hte above inequality is satisfied as long as the signal is sufficiently precise, i. e. $\overline{\sigma}\to 1$, given $p_R R<1+\gamma$. The expected profits of a bank that offers microcredit, i.e does not acquire meaningful signals about borrowers' riskiness, is given by $u_M\equiv p_M(1+r_M)-(1+\gamma)$, where

$$p_M\equiv Pr(S)p_S+Pr(R)p_R \tag{11}$$

where we recall that $P(S)$ and $P(R)$ are the probabilities that an applicant is, respectively, safe or risky given the pool of applicants for microcredit contracts. We assume $p_M R>1+\gamma$ so that there exist values of r_M such that microcredit is profitable to banks. Note that, for any given $r_M=r_B$, $u_B>u_M$ holds – so that standard credit becomes profitable compared to microcredit – for c small enough, since $\overline{\sigma}>0.5$ and $p_R<p_S$. Furthermore, since waiting is costly for borrowers, either a bank offers microcredit, in which case lending is not conditional on signal, or it offers standard credit and undertakes screening, and lends only to borrowers for whom the resulting signal is positive.

3.2 Timing and equilibrium concept

Banks and borrowers play 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 loan application they receive;

Stage 4: Exchange, if any, takes place.

In our analysis, we restrict our attention to robust subgame perfect Nash equilibria (SPNE). More precisely,

Definition 1 (SPNE)**.** An equilibrium is a set of strategies for borrowers and lenders such that agents' strategies are their best responses given the others' at each stage of the game.

4 Laissez-Faire Economy

In this section we study the equilibrium in the case of an economy under full financial liberalization. Then, we analyze the consequences of financial repression in the form of interest rate ceilings as far as the development of microcredit loans is concerned.

4.1 Equilibrium characterization

Compared to safe borrowers, risky borrowers have a lower propensity to borrow under bank standard credit contracts as they face a would-be lower probability to be financed given that lending is conditional upon the lender receiving an informative signal that the borrower is safe. Therefore, in principle, one could think of a separating equilibria (SE) in which safe types separate from risky types. However, because of adverse selection, the following result holds,

Lemma 1 (No separation according to risk)**.** *There is no equilibrium in which safe borrowers separate.*

Proof. See appendix.

The intuition is as follows. Consider a SE where all risky borrowers are separated from safe ones. Risky borrowers would be unable to borrow as their projects have a negative expected net present value (NPV). Differently, safe borrowers will be able to borrow as their projects have a positive expected NPV. Moreover, 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. Moreover, there is no equilibrium in which some safe borrowers separate by applying for bank standard credit subject to screening. In fact, if only safe borrowers are applying for credit subject to screening, banks do not have incentive to screen, which destroys such equilibrium.

Given lemma 1, the equilibrium candidates are: (a) pure strategy SE, with transparent borrowers applying for bank standard credit and opaque ones applying for microcredit; (b) pure strategy pooling equilibria (PE), with all borrowers demanding either standard credit or microcredit; and (c) mixed strategy SE in which all transparent borrowers and some opaque ones go for standard credit and the remaining opaque borrowers go for microcredit. We analyze each equilibrium candidate in turn and then characterize the equilibrium of the credit market depending on parameter values.

4.1.1 Separating equilibria (SE)

A borrower of type θ prefers standard credit to microcredit if and only if

$$\beta^{t_\tau}\sigma_{\rho S}[R-(1+r_B)] \geq R-(1+r_M) \tag{12}$$

A necessary condition for this to happen is that

$$\sigma_{\rho S}[R-(1+r_B)] \geq R-(1+r_M) \tag{13}$$

Restrict attention to values of parameters and endogenous variables that satisfy the above condition. Define,

$$\beta_{\tau,\rho} \equiv \left\{\frac{R-(1+r_M)}{\sigma_{\rho S}[R-(1+r_B)]}\right\}^{\frac{1}{t_\tau}} \tag{14}$$

as the critical value of β such that a borrower of type θ is indifferent between a microcredit and a standard credit contract, where r_M and r_B are their respective costs of credit, and $t_\tau$is the type-contingent waiting time associated with the standard credit contract. Clearly, the minimum and maximum values of $\beta_{\tau,\rho}$ are $\beta_{T,S}$ and $\beta_{O,R}$, respectively. Risky and opaque borrowers are the least propense to standard credit, while safe and transparent are the most propense ones. We assume that independently of riskiness, in any equilibrium, opaque borrowers are less propense to standard credit than transparent ones, which implies assuming that $\beta_{T,R} < \beta_{O,S}$. We develop the necessary and sufficient conditions for this to happen in the proofs of the relevant lemmata and propositions. The inequality always hold for t_O large enough and the interpretation of the assumption is, consistent with the findings in Chandavarkar (1992) and Beck, et al. (2008), the screening process is a genuine hurdle for opaque borrowers to access financial services. The following result applies

Lemma 2. *The SE, if it exists, is unique: (i) all transparent borrowers demand standard credit according to the contract, $C_B^* = \{r_B^*, t_T\}$; (ii) all opaque borrowers demand microcredit, $C_M = \{r_M^*, 0\}$; where,*

$$\begin{aligned}
1+r_B^* &= \tfrac{1}{p_B}\left[1+\gamma+\tfrac{c}{Pr(s=S)}\right] \\
p_B &= \tfrac{\overline{\sigma}\pi}{\overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi)}p_S + \tfrac{(1-\overline{\sigma})(1-\pi)}{\overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi)}p_R \\
Pr(s=S) &= \overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi) \\
1+r_M^* &= \tfrac{1+\gamma}{p_M} \\
p_M &= \pi p_S+(1-\pi)p_R
\end{aligned}$$

(iii) rationing only takes place in the standard credit market, and (iv) the probability of credit rationing is $\lambda[(1-\pi)\overline{\sigma}+\pi(1-\overline{\sigma})]$. *A necessary condition for the existence is* $\beta \in [\beta^*_{T,R}, \beta^*_{O,S}]$.

Proof. See appendix. □

According to the above result, in a credit market where both standard credit (subject to screening) and microcredit are supplied, transparent borrowers go for standard credit and opaque ones go for microcredit. This requires that $\beta \leq \beta_{O,S}$ and $\beta \geq \beta_{T,R}$. Note that although, in principle, lenders cannot observe whether a borrower is transparent or opaque, contracts are still conditional on transparency/opaqueness of the borrower as far as waiting time is concerned, since the bank waits long enough to extract the signal before issuing the loan. Therefore, opaque borrowers know that they would have to wait t_O in order to get the loan. In order for an SE to exist, t_O should be large enough that opaque and transparent prefer microcredit. Differently, t_R should be small enough that, in spite of having a lower chance to obtain credit, risky and transparent borrowers prefer standard credit to microcredit.

4.1.2 Pooling equilibrium (PE)

The following result holds,

Lemma 3. *Any PE with financial exchange, when it exists is unique and characterized as follows: 1. If* $\beta \geq \beta^*_{O,S}$ *all borrowers demand standard credit: (i) the bank standard credit contract is* $C^*_B = \{r^*_B, t\}$, *where* $t = t_T$ *for transparent borrowers and* $t = t_O$ *for the opaque ones, and*

$$\begin{aligned} 1+r^*_B &= \frac{1}{p_B}\left[1+\gamma+\frac{c}{Pr(s=S)}\right] \\ p_B &= \frac{\overline{\sigma}\pi}{\overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi)}p_S + \frac{(1-\overline{\sigma})(1-\pi)}{\overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi)}p_R \\ Pr(s=S) &= \overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi) \end{aligned}$$

(ii) the probability of rationing is $(1-\pi)\overline{\sigma}+\pi(1-\overline{\sigma})$*; 2. If* $\beta \leq \beta^*_{T,S}$, *all borrowers demand microcredit: (i) the microcredit contract is* $C^*_M = \{r^*_M, 0\}$, with

$$\begin{aligned} 1+r^*_M &= \frac{1+\gamma}{p_M} \\ p_M &= \pi p_S + (1-\pi)p_R \end{aligned}$$

(ii) all borrowers are financed. The necessary condition for existence is *either* $\beta \geq \beta^*_{O,S}$ *or* $\beta \leq \beta^*_{T,S}$.

Proof. See appendix.

When all borrowers pool under the same contract, either banks only supply standard credit with screening or supply only supply microcredit. Note that the risk composition of the pool of applicants in a PE with microcredit is the same as that of the pool of applicants to microcredit contracts in the case of a SE so that the equilibrium interest rate, r_M^*, is the same in both equilibria. The same is true for applicants to standard credit.

4.1.3 Mixed strategy equilibria

According to lemmata 2-3 the economy could be in a SE with pure strategies only if $\beta \in [\beta_{T,R}^*, \beta_{O,S}^*]$ and in a PE if and only if either $\beta \geq \beta_{O,S}^*$ or $\beta \leq \beta_{T,S}^*$, with $\beta_{\tau,\rho}$ evaluated at the equilibrium interest rates and waiting times, which are the same across SE and PE equilibria. Therefore, no SE or PE in pure strategies exists if $\beta \in [\beta_{T,S}^*, \beta_{T,R}^*]$. In this case, the following result holds,

Lemma 4. *$\beta \in [\beta_{T,S}^*, \beta_{T,R}^*]$ is a necessary condition for the existence of a SE in mixed strategies, such that: (i) banks offer a microcredit contract $C_M^{**} = (r_M^{**}, 0)$, and standard credit contract $C_B^{**} = (r_B^{**}, t_\tau)$, with $t_\tau = t_O$ for opaque borrowers, $t_\tau = t_T$* for transparent ones, and

$$\begin{aligned}
1 + r_B^{**} &= \frac{1}{p_B}\left[1 + \gamma + \frac{c}{Pr(s=S)}\right] \\
p_B &= \frac{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]}{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]+(1-\overline{\sigma})(1-\pi)\lambda} p_S + \frac{(1-\overline{\sigma})(1-\pi)\lambda}{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]+(1-\overline{\sigma})(1-\pi)\lambda} p_R \\
Pr(s=S) &= \frac{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]+(1-\overline{\sigma})(1-\pi)\lambda}{\lambda+\pi(1-\lambda)\alpha^{**}} \\
1 + r_M^{**} &= \frac{1+\gamma}{p_M} \\
p_M &= \frac{\pi(1-\alpha^{**})}{\pi(1-\alpha^{**})+1-\pi} p_S + \frac{(1-\pi)}{\pi(1-\alpha)+1-\pi} p_R
\end{aligned}$$

(ii) All transparent borrowers plus a fraction α^{**} of the opaque and safe ones demand standar credit, while all risky and opaque plus a fraction $1-\alpha^{**}$ of the safe and opaque ones demand microcredit, where

$$\alpha^{**} = \left\{\alpha : \beta = \beta_{O,S}^*\right\}$$

(iii) All borrowers applying for microcredit are financed, and the probability of credit rationing in the market for standard credit is

$$\frac{(1-\overline{\sigma})\pi[\lambda+(1-\lambda)\alpha^{**}] + \overline{\sigma}(1-\pi)\lambda}{\lambda+\pi(1-\lambda)\alpha^{**}}$$

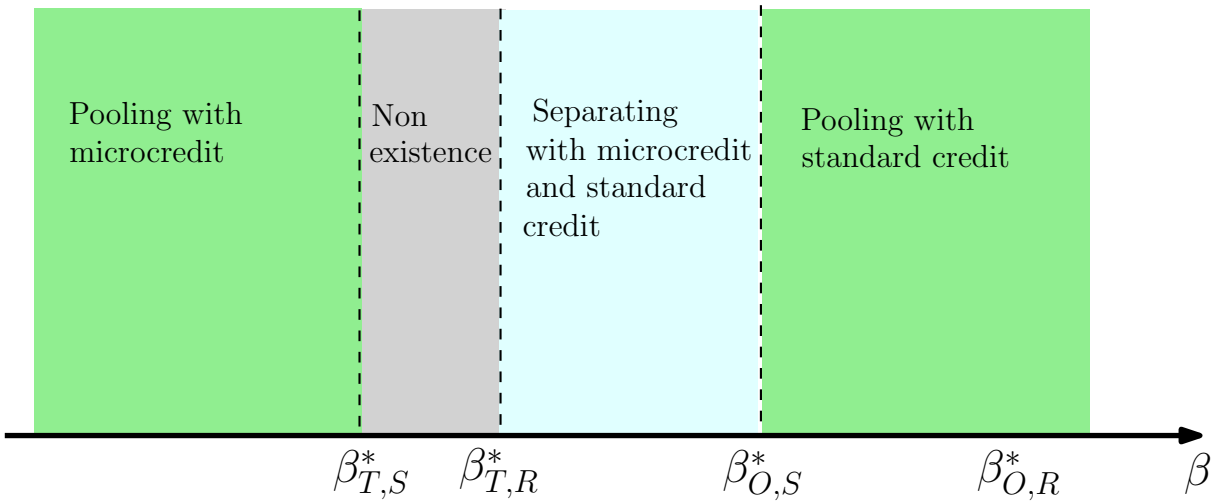

Figure 1: Equilibrium existence

4.1.4 Equilibrium existence

Having characterized separating and pooling equilibria in pure strategies and mixed strategy equilibria, we can now analyze equilibrium existence depending on the values of parameters.

Proposition 1. *Existence and characterization of the equilibrium of the credit market are as follows: (i) if $\beta \in [\beta^*_{T,R}, \beta^*_{O,S}]$, then the unique equilibrium is a SE such that opaque borrowers go for microcredit and transparent ones go for standard credit; (ii) if $\beta \geq \beta^*_{O,S}$ or $\beta \leq \beta^*_{T,S}$, then the equilibrium is a PE such that, if $\beta \leq \beta^*_{T,S}$ all borrowers go for microcredit, and if $\beta \geq \beta^*_{O,S}$ all borrowers go for standard credit; (iii) If $\beta \in [\beta^*_{T,S}, \beta^*_{T,R})$ then there is no equilibrium in the credit market. In the special case in which $\beta = \beta^*_{O,S}$, SE and PE with standard credit coexist.*

Proof. See appendix.

According to the above proposition, if $\beta \geq \beta^*_{O,S}$ all agents pool into standard credit, so all borrowers undergo a screening process and face a positive probability of being rationed. At the opposite extreme, if $\beta \leq \beta^*_{T,S}$, banks only offer microcredit. If $\beta \in [\beta^*_{T,R}, \beta^*_{O,S}]$, then a SE emerges in whiech 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 no screening. No equilibrium exists on the remaing scenario with $\beta \in [\beta^*_{T,S}, \beta^*_{T,R})$. Figure 1 summarizes the results of Proposition 1.

4.2 Efficiency of banking, and credit rationing, efficiency of investment and interest rates

In our model setup, bank efficiency is captured by the quality of the signal that the banks are able to extract through screening, which is measured by the probability of obtaining a correct signal, $\overline{\sigma}$. Bank efficiency affects the equilibrium outcome of the credit market as far as (i) credit rationing; (ii) inefficient investment being financed, and; (iii) efficient investment not being financed, are concerned. Restricting attention to the parameter restrictions such that an equlibrium exists, and abstracting from the special case in which $\beta = \beta^*_{O.S}$, in equilibrium, credit rationing is as follows

$$Pr(rationing) = \begin{cases} 0 & if \;\; \beta \leq \beta^*_{T,S} \\ \lambda[(1-\pi)\overline{\sigma} + \pi(1-\overline{\sigma})] & if \;\; \beta \in [\beta^*_{T,R}, \beta^*_{S,O}] \\ (1-\pi)\overline{\sigma} + \pi(1-\overline{\sigma}) & if \;\; \beta \geq \beta^*_{O,S} \end{cases} \tag{15}$$

Since $\overline{\sigma}$ affects the value of $\beta^*_{T,S}$, $\beta^*_{T,R}$, and $\beta^*_{O,S}$, credit rationing depends upon bank efficiency as reported in Figure 2. Credit rationing is zero if banks are so inefficient that they offer only microcredit. Then, as bank efficiency increases, credit rationing emerges as the SE replaces the PE with microcredit. Further increases in bank efficiency would reduce credit rationing. Credit rationing would raise again as SE is replaced by PE with bank credit, as all borrowers are now subject to screening. And, again, a further increase in bank efficiency would then result in less credit rationing.

Credit rationing is definitely a relevant phenomenon to look at in order to assess the functionality of a credit market. However, quality of credit should also be looked at. In particular, it is important to look at the amounts of inefficent investment being financed and efficient investment not financed, respectively.

Depending on the value of β, the amount of inefficient investment being financed is

$$\begin{cases} 1-\pi & if \;\; \beta \leq \beta^*_{T,S} \\ \lambda(1-\pi)(1-\overline{\sigma}) + (1-\lambda)(1-\pi) & if \;\; \beta \in [\beta^*_{T,R}, \beta^*_{O,S}] \\ (1-\pi)(1-\overline{\sigma}) & if \;\; \beta \geq \beta^*_{O,S} \end{cases} \tag{16}$$

Simlarly to rationing, there is a relationship between the amount of inefficient investment being financed and the efficiency of banks. As for efficient investment, its amount is

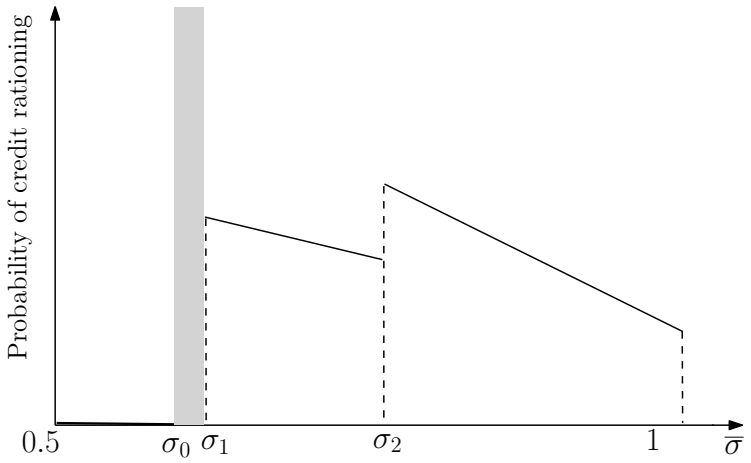

Figure 2: Bank efficiency and credit rationing

$$\begin{cases} 0 & if \;\; \beta \leq \beta^*_{T,S} \\ \lambda\pi(1-\overline{\sigma}) & if \;\; \beta \in [\beta^*_{T,R}, \beta^*_{O,S}] \\ \pi(1-\overline{\sigma}) & if \;\; \beta \geq \beta^*_{O,S} \end{cases} \tag{17}$$

which is again related to bank efficiency. Figures 3 and 4 describe how efficient investment not financed and inefficient investment financed vary with bank efficiency. Inefficient investment financed is maximum when banks provide only microcredit, and declines if banks are efficient enough that the credit market is characterized by both microcredit and standard credit, or only standard credit. As for efficient investment not financed, it equals zero in the case in which banks offer only microcredit. It then increases if banks are efficient enough that standard credit emerges. Further increases in the efficiency of banks result in less efficient investment not bening financed. Finally, Figure 5 describes the relationship between bank efficiency and interest rates. When bank efficiency is low, dispersion of interest rates is minimum, as banks only supply microcredit. As bank efficiency increases and banks start offering standard credit together with microcredit, the dispersion increases. Further improvements on bank efficiency result in higher dispersion as standard credit will be offered at cheaper rates, until dispersion goes back to a minimum if banks are so efficient that they only offer standard credit.

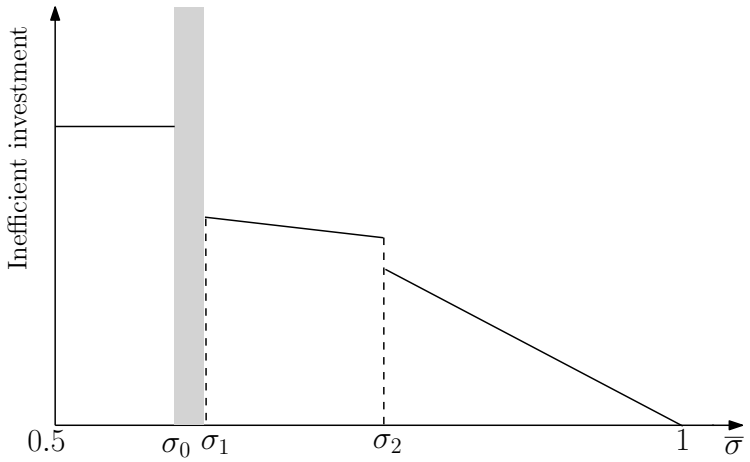

Figure 3: Bank efficiency and inefficient investment being financed

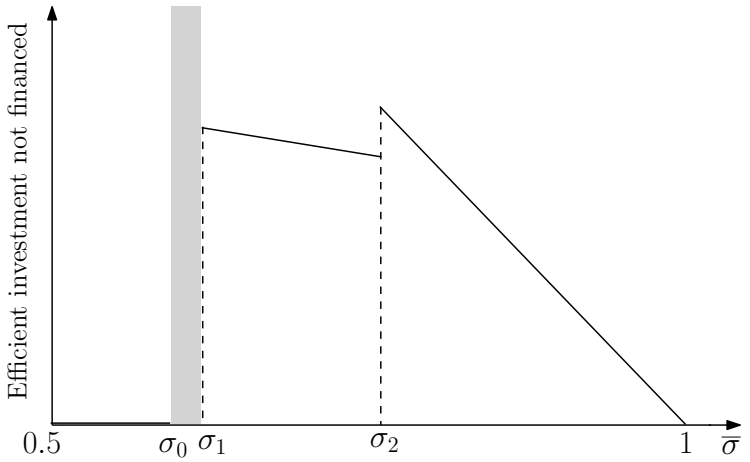

Figure 4: Bank efficiency and efficient investment not financed

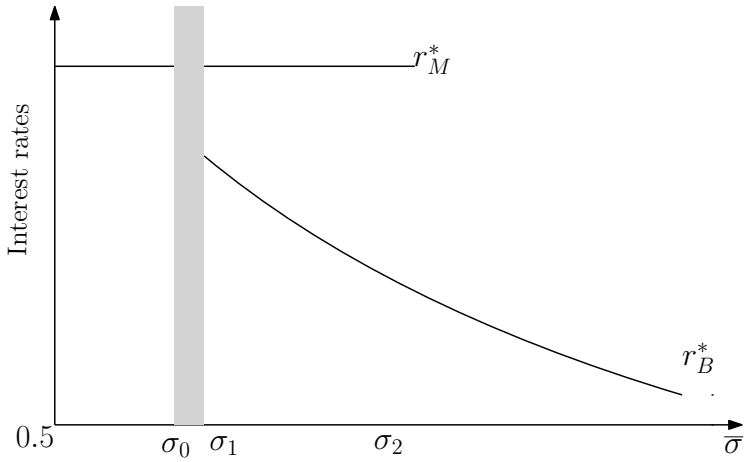

Figure 5: Bank efficiency and interest rates

5 Credit market liberalization and emergence of microcredit

In the absence of regulation of the credit market, focusing on parameter configurations for which the equilibrium exists, the economy finds itself either in a SE or in a PE of the credit market. Consider, now the possibility that the government imposes an interest rate ceiling $\overline{r}$. The following result holds,

Proposition 2. *The real effects of financial repression are as follows: (i) If* $\overline{r} > r_M^*$ *then financial repression has no impact; (ii) if* $\overline{r} \in [r_B^*, r_M^*)$*, then financial repression has an impact if and only if* $\beta \in [\beta_{T,R}^*, \beta_{O,S}^*]$ *or* $\beta \leq \beta_{T,S}^*$*, in which cases the microcredit market shuts down and a PE with standard credit emerges; (iii) if* $\overline{r} < r_B^*$ *then financial repression always has an impact: all credit markets shut down.*

Proof.

The above proposition states interest rate ceilings might result in financial repression by affecting the equilibrium outcome. In particular, interest rate ceilings might prevent the development of microcredit. From a different perspective, financial liberalization policies (where if anti-usury interest rate ceilings are imposed, they take into account the characteristics of each particular credit market) might take promote the development of credit markets, including bank microcredit. Consider a financially repressed economy, in which financial repression exerts a real effect. Then, financial liberalization causes the development of microcredit, whenever the laissez faire economy is not characterized by a PE with standard credit. The development of microcredit results in: (i) lower average waiting time for loan applications; (ii) higher participation in the credit market; (iii) higher average cost of capital; and (iv) higher dispersion of interest rates.

We evaluate the model's predictions regarding the effect of financial liberalization on the cost of credit, and on the development of microcredit by looking at international data and, specifically, at the case of Colombia, which experienced an important financial reform in January 2007.

6 Empirical evidence

In this section we evaluate the model's empirical implications relating the impact of financial liberalization on the market for microcredit by bank MFIs. First, we provide an analysis based on an international sample of banks MFIs. Then, we do a country-specific analysis for Colombia

based on data from the country's downscaling banks before and after a financial liberalization reform that began in January 2007. For this we use a wide array of data sources covering the 2004-2012 period. The MIX is our main data source of international NGO and bank MFIs. The IMF database on international financial reforms compiled in Abaid, et al. (2010) is the source of cross country data on financial liberalization. Data on barriers to banking services is from the survey in Beck, et al. (2008). Data on international banking services is from the World Bank - Doing Business project and the IMF - Financial Access Survey. Bank level data on the Colombian credit market is from the Colombian Financial Superintendence.

6.1 International Evidence: MIX data for Bank MFIs

Tables 1 and 2 contain data on the breadth, outreach, governance and financial performance of the international sample of NGO and bank MFIs surveyed by the MIX for the 2004-2012 period. The data presented is consistent with the multiple findings in the literature arguing that bank MFIs have different approaches and social objectives, and offer distinct loan contracts from their NGO counterparts. The sample contains information on 548 unique NGO MFIs and on 202 unique bank MFIs. None of the surveyed NGO MFIs included in the data set are for-profit institutions and most are unregulated by their own country's financial authorities. Virtually all surveyed bank MFIs are for-profit regulated entities.

Banks have had the highest growth rate between the two types of MFIs, as the portion of "young" and "new" MFIs is higher for banks than for NGOs. As is also reported in the literature, we observe in our data that a tradeoff occurs between the outreach and breadth of MFIs. The outreach or total number of borrowers of bank MFIs is significantly larger than that of NGOs. The breadth or target market of an MFI relates to the size of the average loan. Most NGO MFIs focus in the "low end" of the market, where loans are of $150 USD or less, while bank MFIs target markets where more sizable loans are supplied.

Table 2 further details the management of the loan portfolio of the MFIs and their financial performance. Consistent with addressing a broader target market, the gross loan portfolio, the number of active borrowers, the average size of loans and the average cost per loan is significantly superior for bank MFIs. Measured by total assets, bank MFIs are also bigger than their NGO counterparts.The lending rate, proxied using the real yield on the gross portfolio (Cull, et al., 2007), is greater for NGO MFIs. Capital or equity to asset ratio in NGOs close to doubles that of banks. This is mainly due to the capacity of bank MFIs to receive deposits. The percentage of non-performing loans and profitablity, measured by the return on assets, for both MFIs are

comparable.

Cross correlations are calculated and a regression analysis is performed for an index of country-level financial liberalization, and country-level data on banking services. The financial liberalization index is developed in Abaid, et al. (2010).[2] The range of this index goes from zero to three. A value of zero represents "full repression" in the country's financial system and indicates the existence of government imposed binding interest ceilings in deposit and lending rates. One is called "partial liberalization", and occurs when both rates fluctuate within a band or when one of these rates is subject to a binding ceiling. Two is a form of "limited liberalization" where either one of these rates is freely floating and the other fluctuates within a band. Three indicates "financial liberalization" and can only occur when deposit and lending rates are freely floating.[3] The index includes data on 91 countries from various starting years, starting as early as 1973 until 2005.

We use data on country-level average number of days for commercial banks to process loan applications collected in Beck, et al. (2008) using a survey from 209 banks in 62 countries for 2004 and 2005.[4] The authors analyze how potential price and non-price barriers to banking prevent a significant portion of the population in developing countries from accessing formal banking services. Of interest to us is the tradeoff that may exist between the number of days to process a loan application and a borrower's information opaqueness and a country's level of financial liberalization.

The IMF and the World Bank are the sources for the additional variables included in the correlation analysis. These are the lending rate on short- and medium-term loans to the private sector, the percentage of the country's population surveyed by a private credit bureau, the percentage of the population who are borrowers from a financial institution, an index of credit information depth and the GDP per capita. Considering that the available data on loan processing waiting time corresponds to a single observation per country for the 2004-2005 period, all data used for the correlation analysis are the averages for the 2004 and 2005 reported values. Averages for the bank-level MIX data are weighted on each bank's gross loan portfolio.

The described international data on banking yields some support on the model predictions regarding the effects of financial liberalization on the waiting time of loan applications, the participation of borrowers in the credit markets, and the average cost of lending. Panel A and Panel B of Table 3 presents the summary statistics and correlation matrix, respectively. The coefficients

[2]The data on the index of financial liberalization is made available by the IMF, at http://www.imf.org/external/pubs/cat/longres.aspx?sk=22485.0

[3]Provided that our model considers only financial repression or liberalization on loan rates, a level of inaccuracy is added to the analysis by using this aggregate index which also considers deposit rates in its construction.

[4]The data set is made available by the World Bank at http://go.worldbank.org/S3EWEOI440

of the model's key variables show the expected signs. Although lacking statistical significance, financial liberalization is found to be negatively correlated with the average number of days banks take to process a loan application and positively correlated with the percentage of the population who are borrowers from a formal financial institution. Financial liberalization is significantly and positively correlated with the percentage of the population included in the records of a private credit bureau, with the index of credit information depth and with real GDP per capita.

The model in Eq. (18) aims to measure the effects of financial liberalization on the i. the log of days banks take to process a loan application, ii. the log of the percentage of the population who are borrowers from a formal financial institution, and iii. the log of the interest rate on all loans. Coefficient estimates are presented in Table 4.

$$y_i = \alpha + \beta FL_i + \beta_1 gdp_i + \epsilon_{i,t}. \tag{18}$$

In addition to a constant term, each dependent variable is regressed with respect to financial liberalization and the log of real GDP per capita. The coefficients are estimated using ordinary least squares and instrumental variables to control for possible endogeneity. The instruments include a constant term, financial liberalization, the log of real GDP per capita, the percentage of the population recorded in private credit bureaus and the credit information depth index. The estimation with instrumental variables did not yield distinct results from those using least squares; and for brevity, these are not presented in the table. When regressed only against the constant term and financial liberalization, the effects of financial liberalization on time to process loan applications and on the percentage of borrowers are consistent with the model predictions and are statistically significant. When the model specification includes real GDP per capita for the three regressions, the signs for the estimated coefficients on financial liberalization are as predicted by the model, although these do not posess statistical significance.

6.2 Country-specific evidence: Colombian data for Bank MFIs

Colombian commercial banks have had until recently a narrow presence in the country's microcredit market, leaving NGO MFIs as the almost exclusive suppliers of microcredit to the formal sector of the economy.[5] Table 5 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. The main differences on how NGOs and banks approach microfinance, illustrated in Tables 1 and 2, are also observable in the sample of Colombian

[5]See Presbitero and Rabellotti (2014) for a comprehensive account of microcredit lending in Colombia.

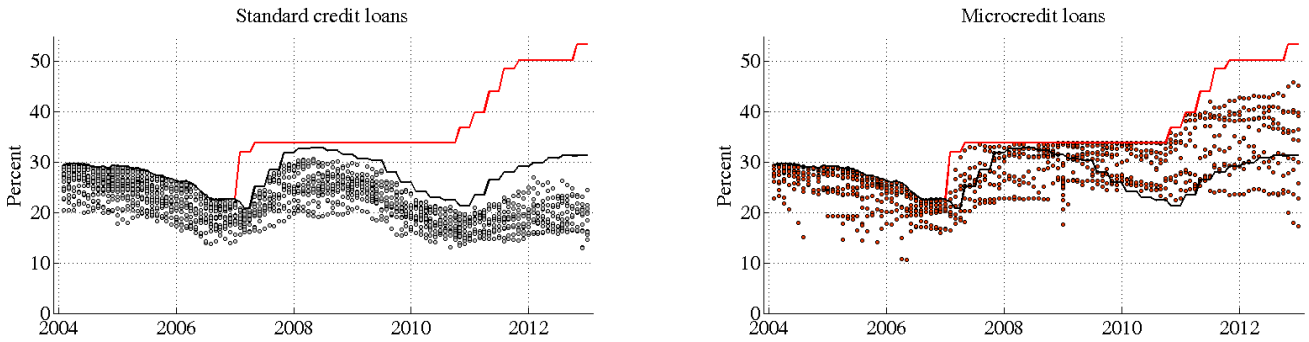

Figure 6: The figures present the average monthly interest rates levied by Colombian banking institutions for standard (left) and microcredit (right) loans from 2004:01 to 2012:12, and the historical anti-usury rates on these types of loans as established by the Colombian banking authorities. The black line is the interest rate ceiling of standard credit loans and the red is that of microcredit loans. Data source: Colombian Financial Superintendence.

MFIs.

A change in the financial regulation recently occurred in Colombia that resulted in a more significant presence of the traditional banking sector in the microcredit market. This occurred on January 2007,[6] when the anti-usury law governing over the banking sector was amended and, consequently, relaxed. The new legislation abolished an existing global interest rate ceiling for all financial sector loan types, and in its place established distinct interest rate ceilings for distinct categories of loans. Anti-usury legislation in the form of a interest rate ceiling exists in Colombia since 1971, and previous to January 2007 only allowed for the existence of a unique interest rate ceiling that delimited the upper bound of all loans originated by financial institutions in the country. The new Colombian anti-usury legislation created an interest rate ceiling exclusive for microcredit loans originated by financial institutions that is distinct and superior from the ceiling that standard credit loans are subject to.

Table 6 and Figure 6 evidence the structural changes observed in the Colombian credit markets following the financial liberalization that began in January 2007. The source of the data is the Colombian Financial Superintendency.[7] The Colombian credit market resembles the environment characterized by Proposition 2 where an interest rate ceiling could result in financial

[6]Reference: Decree 3078 of September 8, 2006.

[7] For our analysis of the Colombian credit market, we consider consumer loans to be analogous to the standard credit loans refered to in our model. We estimate that the average size of consumer loans in Colombia to be 21% greater than the average size of microcredit loans. According to the Colombian Financial Superintendence, the total volume of consumer loans in the Colombian banking system in 2012:Q3 was 34.9 billion USD. For the same period, according to the Colombian Superintendence of Industry and Commerce, the amount of individual borrowers of consumer loans was 4,851,998. These aggregate statistics yield an average value for consumer loans of 7,197 USD. According to the MIX data set, the average loan size of microcredit loans from bank MFIs in 2012 was 5,692 USD.

repression by affecting the equilibrium outcome, and its removal might promote the development of credit markets, including bank microcredit.

Table 6 presents the average lending rates average usury rate and total new loans (in millions USD) of standard credit and microcredit loans for 2004-2006, 2007-2009 and 2010-2012 by all Colombian commercial banks, and separately by downscaled banks and by specialized banks. Downscaled banks are those offering microcredit alongside standard credit in a specific period, and specialized banks are those offering only one type of loan contract at each time period, e.g. either standard credit or microcredit, but not both.

The nine year period 2004-2010 was one of considerable growth for Colombia on both credit market segments. The aggregate value of new microcredit loans, in millions of USD, for the 2004-2006, 2007-2009 and 2010-2012 periods are 483, 1,538 and 3,443 respectively. After the differentiation in interest rate ceilings, the cap on the rates of microcredit loans has always exceeded that of standard loans, and microcredit lending by traditional banks has significantly surged. The left and right panels in Figure 6 depict the average monthly interest rates for standard and microcredit loans supplied by these institutions from 2004:01 to 2012:12, respectively. The panels in Figure 6 contain also the government imposed anti-usury rates on both types of loans. Previous to the financial liberalization reform no banking institution could price microcredit loans at rates higher than the anti-usury rates that these contracts shared with the standard loan contracts. After the reform, banks priced their microcredit loans at levels higher than the anti-usury rates of standard loans, but lower than the microcredit usury rate. The aggregate volume of bank microcredit loans offered at rates above the standard credit usury rate for 2007-2009 and 2010-2012 were 973 and 3,201 million USD, respectively. These values respectively correspond to 63% and 88% of all microcredit originated in the Colombian banking sector during these periods.

Downscaling banks supplied most of the bank microcredit in Colombia following the financial reform of 2007. The cumulative value of new microcredit loans for downscaling banks was 1,243 million USD for the 2007-2009 period, compared to 296 million USD for specialized bank MFIs. It is important to note that specialized bank MFIs significantly increased their supply of microcredit to the Colombian credit market the years after the financial liberalization. The cumulative value for 2010-2012 of new microcredit loans by downscaling banks was 1,631 million USD, and by specialized microcredit banks was 1,813 million USD. The average rates for microcredit loans from downscaling banks are lower than those from specialized microcredit banks.

Among our model predictions is that financial liberalization could foster the development of microcredit and, with it, increase the average cost of capital, and generate a higher dispersion in the interest rates of microcredit and standard loans. We test the above implications using

a panel data on the Colombian market for standard and microcredit loans originated by the country's banking sector before and after the financial liberalization of 2007. The commercial banks included or the regression analysis are those which have consistently offered microcredit contracts alongside standard credit loans in Colombia throughout the considered time horizon; that is, the downscaling Colombian banks. The criteria for selecting a commercial bank into the analyzed sample is that the bank has offered both loan contracts jointly in at least twelve months within 2004:01 and 2012:12, and the monthly average amount of total new loans for each loan type is greater than or equal 25,000 USD. These criteria ensure that our sample includes exclusively commercial banking institutions consistently engaged and vested in supplying the Colombian credit market with both standard credit and microcredit loans. Eight commercial banks fulfill these criteria.

Descriptive statistics on key variables relevant to the supply of microcredit and the financial performance by the sample of Colombian downscaling banks are included in Table 7 for 2004-2006, 2007-2009 and 2010-2012. Seven of the eight banks were operational and offered both types of loans during the 2004-2006 period. Two of these seven banks were dropped from the sample in the 2007-2009 period because they were acquired by other commercial banks within the sample. For the last three-year period one of the commercial banks was also dropped from the sample because it did not continue offering both types of loan contracts to borrowers, and another bank was added to the sample because it started operations in Colombia and fulfilled both criteria for joining the sample.

Table 7 presents asset-weighted average values for the ratio between the flow of new microcredit loans and new standard credit loans being originated at time t from bank i, or $Vol^M_{i,t}/Vol^B_{i,t}$, , for the average of the lending rates for both loan-types, or $avg\left(r^M_{i,t}, r^B_{i,t}\right)$, and the spread between the costs of microcredit and standard credit to borrowers $r^M_{i,t} - r^B_{i,t}$. The average of the lending rates and interest spreads increased significantly following the financial liberalization reform. Alas, such is not the case for the mean value of $Vol^M_{i,t}/Vol^B_{i,t}$. Table 7 also contains the definitions and average values for the interbank rate, capital to assets ratio, loan loss rate, ROA, cash to deposits ratio and total assets for the banks.

Table 8 contains the correlation coefficients for the statistics on the supply of microcredit from the Colombian downscaling banks, as well as for the banks' performance statistics. Again, while the average lending rates and interest rate spreads increased significantly with financial liberalization, such is not the case for the ratios of microcredit to standard credit loans. These statistics on the development of microcredit are significantly correlated with most of the considered bank performance ratios. Considering the latter, we assess the impact of financial liberalization on these

statistics of bank microcredit through a regression analysis that controls for these performance ratios.

Financial liberalization on the development of microcredit by Colombian commercial downscaling banks is tested according to the following model,

$$y_{i,t} = \alpha_i + \beta FL_t + \beta_1 \boldsymbol{C}_t + \beta_2 \boldsymbol{B}_{i,t} + \epsilon_{i,t}. \tag{19}$$

where dependent variable $y_{i,t}$ is the ratio of new microcredit to new standard credit loans at time t from bank i ($Vol^M_{i,t}/Vol^B_{i,t}$) and is regressed against vector α_i of bank fixed effects, the financial liberalization index FL_t, time-variant country controls $\boldsymbol{C}_t$ and time-variant bank-level controls $\boldsymbol{B}_{i,t}$. The financial liberalization index FL_t is our main independent variable, which assumes a value of zero previous to January 2007 and one afterward. Country level $\boldsymbol{C}_t$ includes Colombian interbank interest rate r_t. Controls $\boldsymbol{B}_{i,t}$ are chosen based on the traditional controls of the banking literature. The first group of these bank controls contains the proxies of the CAMEL statistics for each Colombian bank as measures of the bank's financial health. The CAMEL statistics used for our analysis are capital adequacy, asset quality, earnings and liquidity. Proxies for these are constructed following Duchin & Sosyura (2014) and Berger & Roman (2015), and the data sources are the monthly bank Call Reports made available by the Colombian Financial Superintendence. The capital to asset ratio is the measure of the bank's "capital adequacy" and measures the bank's capacity to absorb potential losses. "Asset quality" is measured using the loan loss rate. The return-on-assets (or ROA) is used as the proxy for "earnings", and the cash-to-deposits ratio as that for "liquidity". As is customary in the literature, see Cornett et al. (2013), we control for changes in bank size and the level of bank size by including log(assets) and a size dummy that assumes a value of one if a bank's assets at time t exceeded 10 billion USD. Finally, we consider a dummy variable indicating that the bank had been acquired by another bank during the analyzed period. Observations are monthly, extending from January 2004 to December 2012; i.e. $t = \{1, ..., 108\}$.

The regression results are presented in Table 9.[8] We report coefficient estimates for our baseline regression specification (column 1) where all controls are used for the estimation of Eq. (19) for the full sample of eight Colombian banks, as well as for alternate specifications with different combinations of the control variables (columns 2-4), and for two subsets of the original sample of Colombian banks (columns 5 and 6). The subset of banks analyzed in the regression at column 5 includes those downscaling banks from the original sample that offered jointly both

[8]For brevity, coefficient estimates for the banks' fixed effects and the M&A dummy are not presented in the table.

loan contracts in at least sixty months within the 2004:01 to 2012:12 period. This subsample includes five banks, and are arguably a more experienced subset of lenders in the sample. The sample subset included in the regression in column 6 includes the two biggest banks in the sample. These two banks offered microcredit alongside standard credit loan contracts throughout all of the 2004:01 to 2012:12 period. Combined, these two banks supplied on average 24.4% of the total commercial bank microcredit in Colombia along this time period.

Financial liberalization has a positive and statistically significant impact on the relative volume of new microcredit loans in all regression specifications. On average, for the baseline specification, the enactment of the financial liberalization reform is associated with a 2-percent increase in the ratio of new microcredit loans to new standard credit loans. This value is fairly consistent accross all regression specifications and is always statistically significant. The interbank rate does not have a discernible impact on the loans ratio. An increase in the proxy for the bank's capital adequacy is found to decrease the average ratio of new microcredit to new standard credit loans. A banks' asset quality, proxied by the total loan loss rate, has no statistically significant effect on the ratio of new loans for any of the specifications involving the original sample of banks. For the regressions analyzing the behaviour of the most experienced lenders in the sample, e.g. columns 5 and 6, we found that increases in the loan loss rate negatively impact new microcredit loans compared to new standard credit loans. Banks' earnings, measured by ROA, are statistically significant and negative for the broader sample of banks (columns 1-4). These coefficients are positive and statistically insignificant in the two regressions considering the subsamples of more experienced banks. This suggests that, with increases in income, seasoned downscaling banks favor new microcredits loans to standard credit loans more than the overall sample of downscaling banks. Liquidity is found to increase the ratio of microcredit to standard credit loans for all models studied. Noteworthy is the result that while bank size has no statistically significant impact on the ratio of new microcredit to standard credit loans, the value of this dependent variable decreases with marginal increases of the bank size. These results imply that while bank size does not directly affects the banks' ratios between the two types of new loans, increases in bank size tend to favor new standard credit loans over new microcredit loans.

Finally, we assess the impact of financial liberalization on the average cost of capital and the interest spreads between microcredit and standard credit loans for downscaling banks by modifying Eq. (19) such that the dependent variable $y_{i,t}$ now becomes $avg\left(r_{i,t}^{M}, r_{i,t}^{B}\right)$ and $(r_{i,t}^{M} - r_{i,t}^{B})$. Estimates for the coefficients are presented in Tables 10 and 11, respectively. As before, various regression specifications of Eq. (19) are considered for the full sample of eight Colombian banks (columns 1-4), and for the two subsamples of more seasoned downscaling banks (columns 5 and 6).

The model's predictions are also confirmed: financial liberalization has a positive and statistically significant impact on the average cost of capital and in the dispersion of the interest rates of both types of bank loans. After the financial reform, on average at the baseline regression equation the average cost of capital increased 185 basis points and the rates spread of microcredit and standard credit loans increased 252 basis points. These coefficients are significant and theirs values are consistent among all the model specifications.

7 Conclusions

The paper analyzes a competitive model of credit markets characterized by adverse selection where borrowers are heterogeneous with respect to riskiness of their prospects and informational transparency, and banks have access to a screening technology that enables them to extract a signal about the perspective borrower's riskiness enough time is devoted to process the loan application. Crucially, the time necessary for signal extraction depends on the degree of informational transparency of the borrower. This model intends to replicate the behavior by which traditional banks enter the microcredit market while still engaging in standard credit practices –a practice commonly referred to as "bank downscaling".

We showed that in the laissez-faire economy, depending on parameter values, we could either have an equilibrium where banks only offer credit conditional on screening or an equilibrium 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 draws important implications on the relationship between the efficiency of bank screening and credit rationing, the efficiency of investment and interest rates.

The model also predicts that regulation of credit markets by interest rate ceilings can result in financial repression preventing banks' downscaling into credit markets. Conversely, financial liberalization might be associated with the development of bank microcredit and, with it, lower average waiting time for loan applications, higher average cost of capital, higher dispersion of interest rates, and a higher participation in the credit market. The analysis of an international cross-section of banking data and of a panel data of the Colombian credit market confirms these main insights if the model.

A Appendix

A.1 Sorting condition

Lemma 5 (Sorting Conditions)**.** *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 $t_1 < t_2$, and. Then, other things equal, (i) If a risky borrower prefers C_B over C_M then, a safe borrower strictly prefers C_B to C_M; (ii) If an opaque borrower prefers C_B over C_M then a transparent borrower strictly prefers C_B over C_M.*

Proof. Part i. If a risky borrower prefers C_B over C_M then,

$$(1-\overline{\sigma})p_R\beta^{t_2}[R-1+r_2] \geq p_R\beta^{t_1}[R-1+r_1)]. \tag{20}$$

But then, given $\sigma > 0.5$, □

$$\overline{\sigma}p_S\beta^{t_2}[R-(1+r_2)] > p_S\beta^{t_1}[R-(1+r_1)] \tag{21}$$

holds. That is, safe borrowers strictly prefer C_B over C_M. As for part 2, it directly follows given that transparent borrowers face a lower bank loan processing time than opaque borrowers, i.e. $t_O > t_T$. □

A.2 Proof of Lemma 1

Consider first a candidate SE where all safe borrowers separate from risky borrowers. Given $p_R R < 1+\gamma$ it must the case that risky borrowers are unable to borrow. Differently, banks' competition to finance safe borrowers implies that in equilibrium banks would set an interest rate equal to $1+\gamma+c/Pr(s=S)$ such that they make zero expected profits. since $p_S R > 1+\gamma+{}^{c}/_{Pr(s=S)}$ it must be the case that safe borrowers are able to borrow at a cost that ensures them strictly positive profits (irrespectively of whether in the equilibrium considered they borrow according to microcredit or standard loan contracts). But then, risky types have always an incentive to mimic safe types which destroys the candidate equilibrium.

Consider now an equilibrium in which only some of the safe borrowers separate from the rest. We can rule out the case in which safe and opaque demand microcredit and the rest of the borrowers demand standard credit. The latter group of borrowers would be facing a higher cost of credit than that faced by safe borrowers and a higher waiting time, which implies that all borrowers have

incentive to go for the microcredit contract. The other possibility is that, according to lemma 5, safe and transparent borrowers separate from the rest by demanding standard credit subject to screening. However in such candidate equilibrium, bankers supplying such loans would find it profitable to deviate and not incur the screening cost, which destroys the equilibrium. Finally, a situation in which banks offer standard credit without screening only to safe and transparent is not an equilibrium as risky and transparent will find it convenient to deviate and demand such loans which destroys the candidate equilibrium.

A.3 Proof of Lemma 2

First we characterize the SE and then discuss its existence.

i. Processing time. In any SE, the processing time associated with the standard credit contract signed by a borrower of transparency τ must be equal to, t_τ, with $\tau = T, O$, while for microcredit contracts, the processing time will be equal zero, irrespective of transparency. The proof is immediate. Consider a candidate SE in which banks are offering one or more standard credit contracts characterized by processing times greater than t_τ 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 contracts characterized by a slightly higher cost of credit and a lower processing time, which destroys the candidate equilibrium. An equivalent argument leads to $t = 0$ for microcredit contracts.

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

$$\begin{aligned} (PC_B) \quad &: \quad p_B(1+r_B) - \left(1+\gamma+\tfrac{c}{Pr(s=S)}\right) \quad \geq \quad 0 \\ (PC_M) \quad &: \quad p_M(1+r_M) - (1+\gamma) \quad \geq \quad 0 \end{aligned}$$

where PC_i is the participation constraint for standard credit ($i = B$) and microcredit ($i = M$), where p_M, p_B, $Pr(s = S)$, r_B and r_M will be determined in equilibrium. As for a borrower of type θ

$$\beta^{t_\tau} p_\rho \mu \left[R - (1+r_i)\right] \geq 0 \tag{22}$$

where $i = M$ in the case of microcredit and $i = B$ for standard credit, while $\rho = R, S$, and $t = t_O, t_T$ in the case of standard credit (depending whether the borrower is opaque or transparent)

and zero otherwise, and μ is the probability to access credit, which equals $\overline{\sigma}$ for safe borrowers and $1-\overline{\sigma}$ for risky ones.

Considering that we have risky (R) or safe (S), and transparent (T) or opaque (O) borrowers, we have the following four borrowers' incentive compatibility constraints:

$$\begin{array}{rcrcl}
(ICC_{T,S}) & : & \beta^{t_T}\overline{\sigma}p_S\left[R-(1+r_B)\right] & \geq & p_S\left[R-(1+r_M)\right] \\
(ICC_{T,R}) & : & \beta^{t_T}(1-\overline{\sigma})p_R\left[R-(1+r_B)\right] & \geq & p_R\left[R-(1+r_M)\right] \\
(ICC_{O,S}) & : & \beta^{t_O}\overline{\sigma}p_S\left[R-(1+r_B)\right] & \leq & p_S\left[R-(1+r_M)\right] \\
(ICC_{O,R}) & : & \beta^{t_O}(1-\overline{\sigma})p_R\left[R-(1+r_B)\right] & \leq & p_R\left[R-(1+r_M)\right]
\end{array}$$

Note also that although, in principle, banks cannot observe whether a borrower is transparent or opaque, they have the right to make the borrower wait long enough to extract the signal before issuing the loan. Borrowers know they would have to wait t_τ in order to get the loan. That is, t_O applies when computing the ICC for opaque borrowers and t_T applies for transparent ones.

iii. Cost of credit. In a SE the pool of applicants for standard credit contracts consists of a fraction π of safe borrowers and a fraction $1-\pi$ of risky ones. The same applies for the pool applying for microcredit. Therefore,

$$\begin{array}{rcc}
p_B & = & \frac{\overline{\sigma}\pi}{\overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi)}p_S+\frac{(1-\overline{\sigma})(1-\pi)}{\overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi)}p_R \\
Pr(s=S) & = & \overline{\sigma}\pi+(1-\overline{\sigma})(1-\pi) \\
p_M & = & \pi p_S+(1-\pi)p_R
\end{array}$$

Competition among banks implies that banks' participation constraints must be satisfied as strict equalities, so that:

$$\begin{array}{rcc}
1+r_B^* & = & \frac{1}{p_B}\left[1+\gamma+\frac{c}{Pr(s=S)}\right] \\
1+r_M^* & = & \frac{1+\gamma}{p_M}
\end{array}$$

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 and c are sufficiently small.

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

$$\begin{array}{rcrcl}
(ICC_{T,R}) & : & \beta^{t_T}(1-\overline{\sigma})p_R\left[R-(1+r_B)\right] & \geq & p_R\left[R-(1+r_M)\right] \\
(ICC_{O,S}) & : & \beta^{t_O}\overline{\sigma}p_S\left[R-(1+r_B)\right] & \leq & p_S\left[R-(1+r_M)\right]
\end{array}$$

The first inequality is satisfied so long as $\beta \geq \beta^*_{T,R}$ and the second one if , $\beta \leq \beta^*_{O,S}$, so that the necessary condition for the existence of a SE is $\beta \in [\beta^*_{T,R}, \beta^*_{O,S}]$. Recall that we assume that $\beta^*_{T,R} < \beta^*_{O,S}$ so that the interval $[\beta^*_{T,R}, \beta^*_{O,S}]$ is not empty, which ensures that there exist values of β that satisfy the necessary condition for existence. □

A.4 Proof of lemma 3

We characterize PE in which all borrowers demand standard credit and PE in which all borrowers demand microcredit, and then study their existence.

a. PE with standard credit.

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

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

$$(PC_B) : p_B(1 + r_B) - \left(1 + \gamma + \frac{c}{Pr(s = S)}\right) \geq 0$$

As for borrowers,

$$\beta^{t_\tau} p_\rho \mu (R - (1 + r_B)) \geq 0 \tag{23}$$

is the participation constraint for a borrower of riskiness $\rho = R, S$ with $t = t_O$ if the borrower is opaque and $t = t_T$ otherwise, and $\mu = \overline{\sigma}$ for safe borrowers and $\mu = 1 - \overline{\sigma}$ for risky ones.

iii. Cost of credit. In a PE with standard credit the fractions of safe and risky applicants are π and $1 - \pi$, respectively. Therefore,

$$\begin{array}{rcc} p_B & = & \frac{\overline{\sigma}\pi}{\overline{\sigma}\pi + (1-\overline{\sigma})(1-\pi)} p_S + \frac{(1-\overline{\sigma})(1-\pi)}{\overline{\sigma}\pi + (1-\overline{\sigma})(1-\pi)} p_R \\ Pr(s = S) & = & \overline{\sigma}\pi + (1 - \overline{\sigma})(1 - \pi) \end{array}$$

Competition across lenders drive their profits to zero, which implies

$$1 + r^*_B = \frac{1}{p_B}\left[1 + \gamma + \frac{c}{Pr(s=S)}\right]$$

iv. Necessary conditions for existence Borrowers participation constraints are satisfied so long as $R \geq 1 + r_B^*$ holds. Hence, the necessary condition for the existence of a PE with banking contracts, is $p_S R > 1 + \gamma + {}^{c}/_{Pr(s=S)}$, which is satisfied for c and γ sufficiently small.

v. PE with microcredit.

i. Cost of credit and processing time. In a PE with microcredit, processing time equals zero. Banks do not extract any meaningful signal. The fractions of safe and risky applicants are π and $1 - \pi$, respectively. Therefore, the probability of loan repayment is

$$p_M = \pi p_S + (1 - \pi) p_R \tag{24}$$

so that, competition among lenders, yields

$$1 + r_M^* = \frac{1 + \gamma}{p_M} \tag{25}$$

ii. Necessary condition for existence: Borrowers' participation constraint. Borrowers participation constraints are satisfied so long as $R \geq 1 + r_M^*$ holds. Hence, a necessary condition for existence is $R \geq (1 + \gamma)/p_M$.

iii. Necessary and sufficient conditions for existence: Microcredit vs Standard credit. In the previous proofs we studied necessary conditions for existence. Here we study necessary and sufficient conditions for existence by analyzing profitable deviations starting from either a SE or a PE candidate equilibrium.

Consider a candidate PE with standard credit. Opaque and safe borrowers expected payoff if applying for standard credit contracts, $\overline{\sigma}\beta^{tO} p_S[R - (1 + r_B^*)]$, is lower than of transparent ones. Suppose a bank deviates and offers a microcredit contract characterized by a cost of credit equal to $r_M^* + \epsilon$, with $\epsilon \to 0^+$.[9] The expected payoff for opaque and safe borrowers applying for the new contract would be, $p_S[R - (1 + r_M)]$. Hence, if $\overline{\sigma}\beta^{tO} p_S[R - (1 + r_B)] \geq p_S[R - (1 + r_M)]$, i.e. if $\beta \geq \beta_{OS}$, the deviation would not be profitable, while it would be profitable otherwise, which provides a necessary and sufficient condition for the existence of a PE with standard credit. Consider now a candidate PE with microcredit. Consider a bank that deviates and offers a standard credit contract $C = (r_B, t_\tau)$. The expected payoff of a transparent and safe borrower

[9]Note that the deviating bank anticipates that the pool at the old contract worsens so that the old contract will not be supplied and all applicants will apply for the new contract, so that r_M^* is the minimum value of the interest rate such that the deviating bank breaks even.

applying for the new contract, whic is equal to $\overline{\sigma}\beta^{t_T}p_S[R-(1+r_B)]$, is higher than that of other types of borrowers. Therefore, $\overline{\sigma}\beta^{t_T}p_S[R-(1+r_B)] < p_S[R-(1+r_M)]$, i.e. $\beta \leq \beta_{TS}$, provides the necessary and sufficient condition for the existence of a PE with microcredit.

A.5 Proof of Lemma 4

In the mixed strategy equilibrium all trasparent borrower are choosing standard credit, all opaque and risky are choosing microcredit, while a fraction α of the opaque and safe borrowers chooses standard credit and a fraction $1-\alpha$ of them is choosing microcredit. Therefore, all transparent borrowers should prefer standard credit to microcredit, all opaque and risky should prefer microcredit, while opaque and safe borrowers should be indifferent between microcredit and standard credit. Let $C_M = (r_M, 0)$ and $C_B = (r_B, t_\tau)$ with $t_\tau = t_T$ for transparent borrowers and $t_\tau = t_O$ for opaque ones. Then, the following constraints need to be satisfied

$$(ICC_{T,S}) \quad : \quad \beta \geq \left\{ \frac{R-(1+r_M)}{\overline{\sigma}\left[R-(1+r_B)\right]} \right\}^{1/t_T} \equiv \beta_{T,S} \tag{26}$$

$$(ICC_{T,R}) \quad : \quad \beta \geq \left\{ \frac{R-(1+r_M)}{(1-\overline{\sigma})\left[R-(1+r_B)\right]} \right\}^{1/t_T} \equiv \beta_{T,R} \tag{27}$$

$$(ICC_{O,S}) \quad : \quad \beta = \left\{ \frac{R-(1+r_M)}{\overline{\sigma}\left[R-(1+r_B)\right]} \right\}^{1/t_O} \equiv \beta_{O,S} \tag{28}$$

$$(ICC_{O,R}) \quad : \quad \beta \leq \left\{ \frac{R-(1+r_M)}{(1-\overline{\sigma})\left[R-(1+r_B)\right]} \right\}^{1/t_O} \equiv \beta_{O,R} \tag{29}$$

We know that, for any feasible r_M and r_B, $\beta_{T,S}$ is strictly greater than $\beta_{\tau,\rho}$, for any type $\theta = (\tau, \rho)$ with $\theta \neq (T, S)$, while $\beta_{O,R}$ is strictly lower than $\beta_{\tau\rho}$, for any type $\theta = (\tau, \rho)$ with $\theta \neq (O, R)$. Therefore, in order for the above to hold for some feasible values of r_M and r_B, we need $\beta_{T,R} > \beta_{O,S}$ to be satisfied. Clearly, this is the case provided that t_O is sufficiently large compared to t_T. Then, suppose that at equilibrium values of r_M and r_B associated with a candidate SE, $\beta \in [\beta_{T,S}, \beta_{T,R}]$ holds. We know that if this is the case, no SE exists. We also know that no PE exists either. Let us consider a candidate equilibrium mixed strategy in which a fraction α of opaque and safe borrowers choose standard credit, i.e. safe and opaque borrowers play standard credit with probability α, while all trasparent choose standard credit and risky and opaque choose microcredit. With $\alpha \to 0$ the values of r_B and r_M associated with such equilibrium would be the same as those of a SE equilibrium. But then, such values would not sustain a mixed strategy equilibrium since $\beta \in [\beta_{T,S}, \beta_{T,R}]$. However, as α increases, the pool of applicants for standard credit improves while the pool of applicants for microcredi worsens. Accordingly, $\beta_{\tau,\rho}$ goes down for any type

θ. Note that for sufficiently high values of α, $\beta_{\tau,\rho} = 0$. This follows from the fact that if only risky borrowers are applying to microcredit, then the value of r_M such that banks break even on microcredit exceeds R as risky borrowers have a negative net expected value projects. Moreover, $\beta_{\tau,\rho}$ is continuous in r_M and r_B. Therefore, there exist a value of α, which we call α^{**} such that $\beta = \beta_{O,S}$. Provided that t_O is sufficiently larger than t_T, for this value of α^{**} all the above ICC constraints will be satisfied, which concludes the proof of the existence of a mixed strategy equilibrium. As for the characterization of the equilibrium values of the contracts associated with such equilibrium and of the extent of credit rationing, this follows directly from the composition of the pools applying for the different contracts, as follows,

$$\begin{aligned}
1 + r_B^{**} &= \frac{1}{p_B}\left[1 + \gamma + \frac{c}{Pr(s=S)}\right] \\
p_B &= \frac{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]}{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]+(1-\overline{\sigma})(1-\pi)\lambda}p_S + \frac{(1-\overline{\sigma})(1-\pi)\lambda}{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]+(1-\overline{\sigma})(1-\pi)\lambda}p_R \\
Pr(s=S) &= \frac{\overline{\sigma}\pi[\lambda+(1-\lambda)\alpha^{**}]+(1-\overline{\sigma})(1-\pi)\lambda}{\lambda+\pi(1-\lambda)\alpha^{**}} \\
1 + r_M^{**} &= \frac{1+\gamma}{p_M} \\
p_M &= \frac{\pi(1-\alpha)}{\pi(1-\alpha)+1-\pi}p_S + \frac{(1-\pi)}{\pi(1-\alpha)+1-\pi}p_R
\end{aligned}$$

A.6 Proof of Proposition 1

In order to proof existence and uniquess we analyze profitable deviations given the candidate SE or PE in pure strategies and SE in mixed strategies discussed in Lemmata 2-4. Consider the case in which $\beta \in [\beta_{T,R}^*, \beta_{O,S}^*]$ which is a necessary condition for a an SE in pure strategies to exist. Assume a bank deviates offering a microcredit contract $C_M^{'} = (r_M^{'}, 0)$, with $r_M^{'} < r_M^*$. For such deviation to be profitable, the quality of the pool of applicants, expressed in terms of the fraction of safe borrowers applying, needs to increase. Note that the critical value, $\beta_{\rho,\tau}$, associated with the deviation is going higher the lower is $r_M^{'}$. Thefore, starting from the candidate equilibrium situation in which $\beta \in [\beta_{R,T}^*, \beta_{S,O}^*]$ and $\beta > \beta_{S,T}^*$ the quality of the pool of applicants for $C_M^{'}$ is going to stay unchanged unless $r_M^{'}$ yields a value of $\beta_{R,T}^{'} = \beta$. At this stage, a further reduction in $r_M^{'}$ would cause the quality of the pool of applicants for $C_M^{'}$ to deteriorate rather than improve as all risky and trasparent borrowers will apply to microcredit, which would make such deviation unprofitable. Only a further reduction of $r_M^{'}$ below the level such that $\beta < \beta_{S,T}$ will cause the pool of applicants to improve. However, at that point, all borrowers will apply for microcredit and the quality of the pool of applicants to microcredit would be the same one of the original SE equilibrium so that the break even level of the interest rate in the microcredit market would be the one associated with the original candidate SE, r_M^*, which proves that there is no profitable deviation $C_M^{'}$. Consider now a deviation $C_B^{'} = (r_B^{'}, t_\tau)$ with $r_B < r_B^*$. For such deviation to

be profitable, the quality of the pool of applicants, expressed in terms of the fraction of safe borrowers applying, needs to increase with respect to the candidate SE. A sufficiently low value of $r_B^{'}$ will cause safe and opaque to choose $C_B^{'}$ which actually implies that such deviation could be profitable. However, if that happens, the quality of the pool applying for the original microcredit contract associated with the candidate SE goes down, which implies that such contract will not be offered anymore. Therefore, all borrowers apply to $C_B^{'}$, making it unprofitable. A further reduction in $r_B^{'}$ will finally attract all borrowers, but then clearly such deviation would be not profitable either. Finally, this proves that $\beta \in [\beta_{R,T}^{*}, \beta_{S,O}^{*}]$ is a necessary and suffiicient condition for the SE to be the unique equilibrium as we already know from lemma 3 that no PE exists under this condition and the same is true for mixed strategies equilibria given lemma 4.

Let us turn to the case in which β satisfies the necessary condition for a candidate PE with standard credit, i.e. $\beta \geq \beta_{O,S}^{*}$. Clearly, no profitable deviation deviation $C_B^{'} = (r_B^{'}, t_\tau)$ with $r_B < r_B^{*}$ exists in this case as the old contract will never be supplied after the deviation and therefore all borrowers will apply to the new one which implies that $C_B^{'}$ results in an expected loss for the deviating bank. As far as deviations related to the microcredit market, i.e. $C_M^{'} = (r_M^{'}, 0)$, we know that in the candidate equilibrium, all borrowers but risky and opaque ones, prefer standard credit to a microcredit contract with $C_M^{*} = (r_M^{*}, 0)$. According, we have to check whether a profitable deviation $C_M^{'} = (r_M^{'}, 0)$, with $r_M^{'} < r_M^{*}$ exists. Clearly, there exist a low enough value of $r_M^{'}$ such that $\beta < \beta_{O,S}^{'}$ so that safe and opaque and risky and opaque prefer microcredit. But given the quality of this pool, the break even value of r_M for deviating banks, would be r_M^{*} , so that the deviation is not profitable if it attracts only opaque borrowers. A furhter reduction in $r_M^{'}$ would eventually cause risky and transparent to prefer microcredit, which makes things even worse, and then only a value of $r_M^{'}$ such that $\beta < \beta_{T,S}$ would result in an improvement of the pool. But then, the quality of the pool would be again such that the break even value of r_M for deviating banks, would be r_M^{*}, which finally implies that no profitable deviation exists. Therefore, $\beta \geq \beta_{O,S}^{*}$, is a necessary and sufficient condition for a PE with standard credit to be the unique equilibrium, as we know that no SE exists if $\beta \notin [\beta_{T,R}^{*}, \beta_{O,S}^{*}]$ and $\beta \notin [\beta_{T,S}^{*}, \beta_{T,R}^{*}]$, see lemmata 2 and 4.

Let us now reflect on the case in which β satisfies the necessary condition for a PE with microcredit, i.e. $\beta < \beta_{T,S}^{*}$. Obviously, no profitable deviation $C_M^{'} = (r_M^{'}, 0)$, with $r_M^{'} < r_M^{*}$ exists. Following the deviation all borrowers will apply for the new contract, which makes it unprofitable for the deviating bank. We already know that if $\beta < \beta_{T,S}^{*}$, borrowers prefer microcredit to the standard credit contract, C_B^{*}. So we need to focus on deviations $C_B^{'}$with $r_B^{'} < r_B^{*}$. By deviating to $r_B^{'} < r_B^{*}$ a bank would first of all attract safe and trasparent borrowers, which in principle

could imply that $r_B^{'} < r_B^*$ might be profitable. However, as $r_B^{'}$ reaches a value such that $\beta \geq \beta_{T,S}$ and safe and transparent start applying for standard credit, the quality of the pool still preferring microcredit worsens. Therefore, credit will be no longer supplied at the original microcredit contract of the PE, so that all applicants turn to $C_B^{'}$, which makes $r_B^{'} < r_B^*$ unprofitable. Further reductions in $r_B^{'}$ will cause the pool of applicants attracted by the deviation to worsen as risky and transparent are attracted first, which further cause the non profitability of the deviation. An even further reduction of $r_B^{'}$ would cause opaque and safe borrowers to be attracted. But then, the quality of the pool applying for the original microcredit contract goes down, so that lenders would refuse credit to all applicants at such contract, and everybody applies to $C_B^{'}$, which makes such deviation unprofitable. So $\beta < \beta_{T,S}^*$ is a necessary and sufficient condition for PE with microcredit to be the unique equilibrium as we know that no SE exists if $\beta \notin [\beta_{T,R}^*, \beta_{O,S}^*]$ and $\beta \notin [\beta_{T,S}^*, \beta_{T,R}^*]$, see lemmata 2 and 4.

Finally, consider the case in which β satisfies the necessary condition for a candidate mixed strategy equilibrium, i.e. $\beta \in [\beta_{T,S}^*, \beta_{T,R}^*]$. Consider a deviation $C_M^{'} = (r_M^{'}, 0)$ with $r_M^{'} < r_M^{**}$. Clearly, all opaque borrowers are attracted. But then, the original standard credit contract, C_B^{**}, associated with the equilibrium is no longer profitable as opaque and safe borrower are no longer applying for it, and lenders will reject all applications to that contract. Therefore, all borrowers will apply for $C_M^{'}$. Accordingly, given the quality of the pool, the break even interest rate on microcredit would be r_M^*. Therefore, since $r_M^* < r_M^{**}$, all deviations satisfying $r_M^{'} \in (r_M^*, r_M^{**})$ are strictly profitable, which implies that no mixed strategy equilibrium exists. Finally, this leads to the conclusion that no equilbrium exists for $\beta \in [\beta_{T,S}^*, \beta_{T,R}^*)$ as we know that no PE or SE exists if such condition is satisfied given lemmata 2 and3.

A.7 Proof of proposition 2

The proof is immediate. First, if $\bar{r} > r_M^*$ it is clear that, being above any of the possible equilibrium rates, the interest rate ceiling has no effect. Second, if $\bar{r} \in [r_B^*, r_M^*)$, the regulation is effective if and only if the equilibrium in the credit market is either by a a SE, which occurs if , which occurs if $\beta \in [\beta_{T,R}^*, \beta_{O,S}^*]$, or in a PE with microcredit, which occurs if $\beta \leq \beta_{T,S}^*$. In both cases, microcredit contracts are not feasible anymore, so that a PE with standard credit emerges. Finally, if $\bar{r} < r_B^*$ then, clearly the credit market shuts down as neither microcredit nor standard credit contracts are feasible.

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Table 1: Descriptive statistics on international MFIs: breadth, outreach and governance

Unique MFIs		NGO: 548		Bank: 202	
Breadth, Outreach and Governance		Mean	Obs	Mean	Obs
Legal Status	For Profit	0%	2,979	97%	1,034
	Regulated	26%	2,909	99%	1,049
Female borrowers		73%	2,535	50%	605
Age	Mature: age>8Y	73%	2,933	56%	1,055
	Young: 5y<age<8y	2%	2,933	12%	1,055
	New: age<5Y	33%	2,933	39%	1,055
Outreach	Small	64%	2,918	32%	940
	Medium	20%	2,918	22%	940
	Large	16%	2,918	46%	940
Target Market	Low End	64%	2,915	20%	934
	Broad	33%	2,915	44%	934
	High End	2%	2,915	14%	934
	Small Business	1%	2,915	22%	934
Geographic Region	Africa	18%	3,075	31%	1,074
	East Asia and The Pacific	18%	3,075	6%	1,074
	Eastern Europe and Central Asia	5%	3,075	28%	1,074
	Latin America and The Caribbean	43%	3,075	26%	1,074
	Middle East and North Africa	12%	3,075	2%	1,074
	South Asia	4%	3,075	7%	1,074

The source of data is the Microfinance Information Exchange (MIX) and correspond to the NGO and bank MFIs surveyed during the 2004-2012 time period. The table presents total observations and percentage values respective to breadth, outreach and management statistics. **Unique MFIs** are the total amounts of unique NGO and bank MFIs surveyed by MIX during the considered time period. The **Legal Status** of an MFI is indicated using its identification or not as a for-profit institution and if its subject to regulatory supervision. **Female borrowers** are the percentages of female borrowers of the MFIs. **Age** of the MFI is captured using categorical variable: "Mature" (older than 8 years), "Young" (between five and eigth years), and "New" (less than five years). **Outreach** of the MFI is measured based on the total number of borrowers served and is characterized using categorical variables "Small"(borrowers<10K), "Medium" (10K<borrowers<30K) or "Large" (borrowers>30K). **Target Market** of the MFI is measured as the average balance of loans divided by the GNI per Capita. The variable is based on thresholds and it is defined using categorical variables: "Low", "Broad", "High" and "Small Business". **Geographic region** refers to the location of the MFI.

Table 2: Descriptive statistics on international MFIs: management and financial performance

Unique MFIs			NGO: 548				Bank: 202	
Financial Perf.	Mean	Median	Std	Obs	Mean	Median	Std	Obs
Loan Portf (000)	$5,919	$1,859	$9,202	3,034	$150,078	$40,091	$236,163	1,041
Borrowers	18,898	5,703	32,466	2,910	84,067	25,510	149,524	933
Loan Size	$546	$312	$568	2,886	$2,468	$1,402	$2,652	910
Cost of Loan	$125	$87	$115	2,409	$407	$283	$374	720
Assets (000)	$7,743	$2,518	$11,881	2,949	$201,688	$70,337	$298,972	1,006
Lending Rate	27.2%	24.7%	15.7%	2,257	19.0%	16.0%	14.1%	753
Capital / Assets	45.2%	40.9%	28.0%	2,921	24.3%	17.2%	18.0%	989
Loan Loss Rate	2%	0%	2%	2,407	1%	0%	2%	777
ROA	0.9%	2.4%	9.0%	2,488	1.0%	1.5%	4.9%	816

The source of data is the Microfinance Information Exchange (MIX) and correspond to the NGO and bank MFIs surveyed for the 2004-2012 time period. The table presents mean, median, standard deviations and total observations respective to management style and financial performance statistics. Data is winsorized to the 10% of the distribution to control for outliers. **Unique MFIs** are the total amounts of unique NGO and bank MFIs surveyed by MIX offering microcredit during the considered time periods. **Loan Portfolio** is the gross loan portfolio and is expressed in thousands of USDs. **Borrowers** are the amount of active borrowers. **Loan size** is the gross loan portfolio divided by the amount of active borrowers and is expressed in USDs. **Cost of Loan** is the average cost for a borrower to obtain a loan from the MFIs, in USD. **Assets** is expressed in thousands of USDs. **Lending rate** is the real yield of the gross loan portfolio. **Capital / Assets** is the equity to asset ratio of the MFI. **Loan loss rate** is the MFI's percentage of non-performing loans. **ROA** is the MFIs' return on assets.

Table 3: Descriptive statistics and correlation matrix for international banking

Panel A: Descriptive Statistics	Mean	Median	Std Dev	Min	Max	Obs/Countries
1 Financial liberalization	2.74	3.00	0.61	0.00	3.00	54
2 Days to process: all loans	4.45	2.82	4.11	0.73	20.71	68
3 % Population: borrowers	13.0%	6.6%	19.1%	0.22%	88.0%	29
4 Bank interest rates: all loans	17.4%	10.8%	32.0%	1.7%	257.3%	62
5 % Population: credit bureau	19.5%	0.90%	29.6%	0%	100%	65
6 Credit information: depth index	3.09	3.50	1.97	0	3	69
7 Real GDP per Capita	$7,147	$2,538	$10,129	$97	$39,429	69

Panel B: Correlations	1	2	3	4	5	6	7
1 Financial liberalization	1.0						
	[54]						
2 Days to process: all loans	-0.18	1.0					
	[54]	[68]					
3 % Population: borrowers	0.26	-0.28	1.0				
	[23]	[28]	[29]				
4 Bank interest rates: all loans	-0.15	-0.12	-0.20	1.0			
	[47]	[61]	[26]	[62]			
5 % Population: credit bureau	0.23*	-0.31*	0.54*	-0.13	1.0		
	[53]	[64]	[27]	[58]	[65]		
6 Credit information depth index	0.35*	-0.18	0.53*	-0.19	0.65*	1.0	
	[54]	[68]	[29]	[62]	[65]	[69]	
7 Real GDP per Capita	0.23*	-0.36*	0.23*	-0.19	0.49*	0.47*	1.0
	[54]	[68]	[29]	[62]	[65]	[69]	[69]

Cross correlation coefficients (Pearson) for all variables. * indicates statistical significance of less than 10%. The numbers in brackets indicate the amount of valid observations used to compute each coefficient. The data is derived from varied sources. **Financial liberalization** corresponds to the average value of the financial liberalization index for a country in 2004 and 2005 as developed in Abaid, et al. (2010). Assumes a values 0, 1, 2 and 3, being 3 the highest level of financial liberalization possible. **Days to process: all loans** is a country's average number of days for a commercial bank to process loan applications, as reported in Beck, et al. (2008). **% Population: borrowers** is a country's average percentage of the population with loans from commercial banks for 2004-2005. The IMF Financial Access Survey is the source of the data. **Bank interest rates: all loans** is the average value of the lending rates for short- and medium-term loans to the private sector. The IMF Financial Access Survey is the source of the data. **% Population: credit bureau** is a country's average percentage of the population who are covered by a private credit bureau for 2004-2005. The World Bank, Doing Business Project is the source of the data. **Credit information depth index** is a country's average value of the credit depth index developed by the World Bank for 2004-2005. The World Bank, Doing Business Project is the source of the data. The index ranges from 0 to 6, with higher values indicating the better availability and quality of credit information. **Real GDP per capita** is a country's average real GDP per capita for 2004-2005 as reported by the World Bank national accounts data, and OECD National Accounts data files.

Table 4: Regression coefficient estimates for international banking

	log(Days to process)		log(Borrowers)		log(rate: All Loans)	
Financial liberalization	-0.335	-0.098	1.181	0.602	-0.135	0.067
	(2.9)***	(0.7)	(2.6)**	(1.3)	(0.8)	(0.4)
log(real GDP per capita)		-0.286		0.927		-0.264
		(4.6)***		(7.1)***		(5.1)***
$\mathbf{R^2}$	0.06	0.31	0.17	0.66	0.01	0.26
$\mathbf{R^2}$adj	0.04	0.28	0.13	0.63	-0.01	0.23
N	54	54	23	23	69	69

The definitions of variables are the same as in Table 3. Absolute values of heteroscedasticity-consistent t-statistics in parenthesis . ***, **, * indicates statistical significance of 10%, 5% and 1% respectively.

Table 5: Descriptive statistics on Colombian MFIs

Unique MFIs		NGO: 22		Bank: 5	
Panel A: Breadth, Outreach & Governance		Mean	Obs	Mean	Obs
Legal Status	For Profit	0%	130	100%	33
	Regulated	0%	130	100%	27
Female borrowers		65%	113	59%	20
Age	Mature: age>8Y	95%	130	52%	33
	Young: 5y<age<8y	0%	130	6%	33
	New: age<5Y	42%	130	76%	33
Outreach	Small	54%	128	15%	33
	Medium	18%	128	12%	33
	Large	28%	128	73%	33
Target Market	Low End	57%	128	15%	33
	Broad	43%	128	76%	33
	High End	0%	128	6%	33
	Small Business	0%	128	3%	33

Unique MFIs			NGO: 22				Bank: 5
Panel B: Financial Perf.	Mean	Median	Std	Obs	Mean	Median	Std	Obs
Assets (000)	$33,287	$6,585	$56,158	130	$1,012,242	$247,354	$1,473,402	32
Loan Portf (000)	$24,024	$4,914	$41,187	130	$677,618	$219,986	$944,676	33
Loan Size	$859	$820	$499	128	$2,748	$1,367	$3,046	33
Cost of Loan	$146	$119	$77	110	$484	$284	$516	28
Loans / Officer	350	292	170	123	313	318	165	30
Lending Rate	24.50%	24.20%	9.40%	106	20.70%	20.80%	6.90%	28
Borrowers	34,413	8,398	59,959	128	272,088	192,258	262,450	33
Capital / Assets	41.00%	38.60%	20.90%	130	22.40%	22.80%	13.20%	32
Loan Loss Rate	2%	1%	3%	110	2%	2%	2%	29
ROA	1.10%	3.30%	9.70%	110	0.50%	1.80%	5.90%	27

The source of data is the Microfinance Information Exchange (MIX) and correspond to the Colombian NGO and Bank MFIs surveyed for the 2004-2012 period. The definitions of variables are the same as in Tables 1 and 2.

Table 6: Descriptive statistics of Colombian standard and microcredit loans

	2004-2006		2007-2009		2010-2012	
	standard	microcredit	standard	microcredit	standard	microcredit
All banks						
N	25	17	16	13	20	12
Loan Rates	22.7%	24.4%	23.6%	30.5%	18.4%	34.1%
New Loans (millions USD)	12,885	483	24,368	1,538	47,856	3,443
Downscaling banks						
N	17	17	11	11	10	10
Loan Rates	23.1%	24.4%	23.8%	29.7%	18.2%	30.6%
New Loans (millions USD)	6,998	483	14,116	1,243	22,782	1,631
Specialized banks						
N	8	0	5	2	10	2
Loan Rates	22.3%	-	23.4%	33.9%	18.6%	37.3%
New Loans (millions USD)	5,887	0	10,252	296	25,074	1,813
Usury Rates	27.0%	27.0%	29.3%	33.8%	26.8%	43.8%

The source of all financial data is the Colombian Central Bank. **N** is the amount of all commercial banks, downscaling banks and specialized banks operating in the Colombian credit market during each corresponding three-year subperiod. **Loan 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 new loans of each credit type. **New Loans** are the averages in millions of USD of new credit supplied by Colombian banking instituions for consumer and microcredit loans for the three considered three-years periods. This value is originally reported in COL Pesos, the Colombian Central Bank is the data source for the USD/COL exchange rate. **Usury Rates** are the interest ceilings for consumer and microcredit loans during the three considered three-years periods as determined by the Colombian Financial Superintendency.

Table 7: Descriptive statistics for Colombian downscaling banks

	2004-2006	2007-2009	2010-2012
1 Financial liberalization	No	Yes	Yes
2 $Vol^M_{i,t}$ / $Vol^B_{i,t}$	5.77%	5.13%	3.84%
3 $avg\left(r^M_{i,t}, r^B_{i,t}\right)$	23.96%	26.21%	20.56%
4 $r^M_{i,t} - r^B_{i,t}$	0.18%	5.45%	11.63%
5 Interbank rate	6.56%	8.02%	4.06%
6 capital/assets	11.38%	12.29%	14.73%
7 loan loss rate	1.57%	1.40%	0.93%
8 ROA	2.54%	2.50%	2.30%
9 cash/deposits	4.20%	4.78%	4.90%
10 assets (millions USD)	\$2,963	\$7,454	\$11,175
N: Quantity of banks	7	5	5

Unless otherwise noted, the source of data is the Colombian Financial Superintendence. Data is presented with respect to the 2004-2006, 2007-2009 and 2010-2012 three-year periods and correspond to the eight Colombian commercial downscaling banks included in the sample. All averages are weighted by the assets of each bank. $\mathbf{Vol^M_{i,t}}$ / $\mathbf{Vol^B_{i,t}}$ are the averages of the monthly ratios of new microcredit to standard credit loans originated. $\mathbf{avg(r^M_{i,t}, r^B_{i,t})}$ are the averages of the monthly lending rate averages for microcredit and standard loans. $\mathbf{r^M_{i,t} - r^B_{i,t}}$ are the averages of the monthly differences between the interest rates on microcredit and standard credit loans originated. **Interbank rate** is the average during the periods of the rates for short-term loans between Colombian banks. The source is the Colombian Central Bank. **Capital/assets** are the averages of the monthly ratios between a bank's equity and assets. **Loan loss rate** are the averages of the monthly ratios of non-performing loans to total loans. **ROA** are the averages of the banks' monthly return on assets, measured as the month's ratio of net income to total assets. **Cash/deposits** are the averages of the monthly ratios between a bank's cash and deposits. **Assets** are the averages in millions USD of the monthly total bank assets during the three considered three-years periods. This value is originally reported in COL Pesos, the Colombian Central Bank is the data source for the USD/COL exchange rate. **N** is the amount of banks included in the sample operating during each corresponding three-year subperiod.

Table 8: Correlation matrix for statistics on Colombian downscaling banks

	1	2	3	4	5	6	7	8	9	10
1 Financial liberalization	1.0									
2 $Vol^M_{i,t}$ / $Vol^B_{i,t}$	-0.31*	1.0								
3 $avg\left(r^M_{i,t}, r^B_{i,t}\right)$	0.08*	0.18*	1.0							
4 $r^M_{i,t} - r^B_{i,t}$	0.56*	-0.01	0.35*	1.0						
5 Interbank rate	-0.10*	0.06	0.34*	-0.44*	1.0					
6 capital/assets	0.44*	-0.18*	-0.02	0.55*	-0.37*	1.0				
7 loan loss rate	-0.47*	0.66*	0.22*	-0.21*	0.32*	-0.33*	1.0			
8 ROA	0.07*	-0.25*	-0.11*	0.01	-0.05	0.37*	-0.21*	1.0		
9 cash/deposits	0.09*	0.00	0.18*	0.01*	0.06	-0.06	0.10*	-0.01	1.0	
10 log(assets)	0.37*	-0.05	0.24*	0.54*	-0.07*	0.57*	0.03	0.23*	0.19*	1.0

Cross correlation coefficients (Pearson) for all variables. * indicates statistical significance of less than 10%. Variables are defined as in Table 7

Table 9: Regression coefficient estimates for Colombian downscaling banks - Volume of Microcredit

$\mathbf{Vol^M_{i,t}}$/ $\mathbf{Vol^B_{i,t}}$	1	2	3	4	5	6
$\mathbf{FL_t}$: Financial liberalization	1.99	2.44	2.565	1.784	1.612	2.418
	(4.8)***	(5.6)***	(6.0)***	(4.2)***	(5.0)***	(3.4)***
$\mathbf{C_t}$: Interbank rate	-0.071	-0.128	-0.118	-0.073	-0.006	0.052
	(1.2)	(2.0)***	(1.9)*	(1.2)	(0.1)	(0.5)
$\mathbf{B_{i,t}}$: Capital/asset	-0.139	-0.137	-0.107	-0.170	-0.123	-0.015
	(2.0)**	(1.9)*	(1.5)	(2.4)**	(2.2)**	(0.1)
$\mathbf{B_{i,t}}$: Loan loss rate	-0.256	0.021	-0.101	-0.164	-0.942	-1.839
	(1.1)	(0.1)	(0.4)	(0.7)	(4.7)***	(4.6)***
$\mathbf{B_{i,t}}$: ROA	-0.871		-0.887		0.585	0.501
	(5.3)***		(5.5)***		(3.3)***	(1.7)*
$\mathbf{B_{i,t}}$: Cash/deposits	0.247			0.345	0.279	0.400
	(1.7)*			(2.3)**	(2.4)**	(1.6)*
$\mathbf{B_{i,t}}$: log(Assets)	-2.883	-2.58	-2.84	-2.496	-2.355	-4.055
	(5.6)***	(5.8)***	(6.5)***	(4.8)***	(5.8)***	(5.3)***
$\mathbf{B_{i,t}}$: Assets≥$10Bill	0.051	0.571	0.232	0.339	0.147	
	(0.1)	(1.3)	(0.5)	(0.8)	(0.4)	
$\mathbf{R^2}$	0.911	0.908	0.913	0.907	0.891	0.908
$\mathbf{R^2}$adj	0.909	0.905	0.91	0.904	0.889	0.904
N	555	555	555	555	479	216
Fixed Effects	yes	yes	yes	yes	yes	yes
Number of Banks	8	8	8	8	5	2

Absolute values of t-statistics in parenthesis . ***, **, * indicates statistical significance of 10%, 5% and 1% respectively. The definitions of variables are the same as in Table 8.

Table 10: Regression coefficient estimates for Colombian downscaling banks - Average Cost of Capital

$avg\left(\mathbf{r^M_{i,t}}, \mathbf{r^B_{i,t}}\right)$	1	2	3	4	5	6
$\mathbf{FL_t}$: Financial liberalization	1.325	1.849	1.822	1.383	1.325	1.830
	(2.8)***	(3.8)***	(3.7)***	(2.9)***	(2.8)***	(2.8)***
$\mathbf{C_t}$: Interbank rate	0.611	0.571	0.569	0.611	0.681	1.134
	(8.7)***	(8.1)***	(8.1)***	(8.7)***	(9.4)***	(11.0)***
$\mathbf{B_{i,t}}$: Capital/asset	0.668	0.696	0.690	0.677	0.824	0.859
	(8.3)***	(8.6)***	(8.5)***	(8.5)***	(9.8)***	(9.4)***
$\mathbf{B_{i,t}}$: Loan loss rate	0.674	0.795	0.821	0.648	0.152	-2.226
	(2.5)**	(3.1)***	(3.2)***	(2.4)**	(0.5)***	(6.1)***
$\mathbf{B_{i,t}}$: ROA	0.242		0.191		0.486	1.027
	(1.3)		(1.0)		(1.8)*	(3.7)***
$\mathbf{B_{i,t}}$: Cash/deposits	0.352			0.325	0.287	-0.159
	(2.1)**			(1.9)*	(1.6)	(0.7)
$\mathbf{B_{i,t}}$: log(Assets)	-1.065	-1.315	-1.259	-1.172	-1.331	-1.351
	(1.8)*	(2.6)***	(2.5)**	(2.0)**	(2.2)**	(1.9)*
$\mathbf{B_{i,t}}$: Assets≥$10Bill	1.551	1.647	1.720	1.471	1.424	
	(3.1)***	(3.3)***	(3.5)***	(3.0)***	(2.8)***	
$\mathbf{R^2}$	0.519	0.518	0.518	0.518	0.404	0.639
$\mathbf{R^2}$adj	0.505	0.505	0.505	0.505	0.388	0.625
N	555	555	555	555	479	216
Fixed Effects	yes	yes	yes	yes	yes	yes
Number of Banks	8	8	8	8	5	2

Absolute values of t-statistics in parenthesis . ***, **, * indicates statistical significance of 10%, 5% and 1% respectively. The definitions of variables are the same as in Table 8.

Table 11: Regression coefficient estimates for Colombian downscaling banks - Interest Rate Spreads

$\mathbf{r^M_{i,t} - r^B_{i,t}}$	1	2	3	4	5	6
$\mathbf{FL_t}$: Financial liberalization	2.519	2.438	2.508	2.440	2.607	3.504
	(3.9)***	(3.6)***	(3.7)***	(3.8)***	(3.8)***	(5.2)***
$\mathbf{C_t}$: Interbank rate	-0.637	-0.650	-0.644	-0.638	-0.590	-0.107
	(6.6)***	(6.7)***	(6.6)***	(6.6)***	(5.7)***	(1.0)
$\mathbf{B_{i,t}}$: Capital/asset	0.972	0.925	0.942	0.960	1.106	0.922
	(8.9)***	(8.3)***	(8.4)***	(8.8)***	(9.2)***	(9.7)***
$\mathbf{B_{i,t}}$: Loan loss rate	-0.009	0.132	0.064	0.026	-0.259	-1.943
	(0.0)	(0.4)	(0.2)	(0.1)	(0.6)	(5.1)***
$\mathbf{B_{i,t}}$: ROA	-0.333		-0.495		-0.739	0.057
	(1.3)		(1.9)*		(2.0)**	(0.2)
$\mathbf{B_{i,t}}$: Cash/deposits	0.632			0.669	0.585	-1.088
	(2.7)***			(2.9)***	(2.3)**	(4.7)***
$\mathbf{B_{i,t}}$: log(Assets)	5.954	5.178	5.033	6.102	5.568	4.985
	(7.4)***	(7.5)***	(7.3)***	(7.6)***	(6.4)***	(6.8)***
$\mathbf{B_{i,t}}$: Assets≥$10Bill	-0.013	0.212	0.023	0.097	-0.233	
	(0.0)	(0.3)	(0.0)	(0.1)	(0.3)	
$\mathbf{R^2}$	0.842	0.838	0.840	0.842	0.848	0.957
$\mathbf{R^2}$adj	0.837	0.834	0.835	0.837	0.844	0.956
N	555	555	555	555	479	216
Fixed Effects	yes	yes	yes	yes	yes	yes
Number of Banks	8	8	8	8	5	2

Absolute values of t-statistics in parenthesis . ***, **, * indicates statistical significance of 10%, 5% and 1% respectively. The definitions of variables are the same as in Table 8.

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