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Does Regulatory Supervision Curtail Microfinance Profitability and Outreach?

ROBERT CULL, ASLI DEMIRGÜÇ-KUNT *
World Bank, Washington, DC, USA

and

JONATHAN MORDUCH *
New York University, USA

Summary. — Regulation allows microfinance institutions to take deposits and expand their banking functions, but complying with regulation can be costly. We examine implications for institutions' profitability and their outreach to small-scale borrowers and women, using a newly-constructed dataset on 245 leading institutions. Controlling for the non-random assignment of supervision via treatment effects and instrumental variables regressions, we find evidence consistent with the hypothesis that profit-oriented microfinance institutions respond to supervision by maintaining profit rates but curtailing outreach to women and customers that are costly to reach. Institutions with a weaker commercial focus instead tend to reduce profitability but maintain outreach.

Key words — microfinance, regulation, cross-country regression, global

1. INTRODUCTION

Microfinance institutions now reach well over 100 million clients and achieve impressive repayment rates on loans (Cull *et al.*, 2009). The rapid growth of microfinance has brought increasing calls for regulation, but complying with prudential regulations and the associated supervision can be especially costly for microfinance institutions. The best empirical estimates of the costs of such regulation come not from microfinance or other financial institutions operating in developing countries, but from banks in industrialized countries. For example, by one estimate, the costs of complying with regulation in the US are sizable, equal to 12–13% of banks' non-interest expenses (Elliehausen, 1998; Thornton, 1993). We expect that such costs would be higher for MFIs, and Christen, Lyman, and Rosenberg (CLR) (2003) speculate that compliance with prudential regulations could cost a microfinance institution (MFI) 5% of *assets* in the first year and 1% or more thereafter.

In discussing tradeoffs in regulation of microfinance, Christen *et al.* (2003, p. 3) draw an important distinction between prudential and non-prudential regulation. According to their definition, regulation is prudential when "it is aimed specifically at protecting the financial system as a whole as well as protecting the safety of small deposits in individual institutions." The assets of microfinance institutions remain substantially less than those of formal providers of financial services, most notably banks, and thus they do not yet pose a risk to the stability of the overall financial system in most countries. However, an increasing share of microfinance institutions take deposits from the public, and many of the depositors are relatively poor. Protecting the safety of those deposits provides a rationale for improved regulation and supervision of microfinance institutions, and thus CLR argue that prudential regulations should generally be triggered when an MFI accepts retail deposits from the general public.

There are multiple reasons why costs associated with this kind of regulation are likely to be higher for microfinance institutions. First, regulatory costs exhibit economies of scale and thus smaller banks face higher average costs than larger banks in complying with regulations (Murphy, 1980; Schroeder, 1985; Elliehausen & Kurtz, 1988). Moreover, the start-up costs of regulation display more pronounced scale economies than ongoing costs, because they have a large indivisible component which requires the same amount of time and expense regardless of the scale of bank lending activities. Again, these estimates of scale economies are for US banks. For microfinance institutions in developing countries that have never faced regulation, the costs are likely to be even higher. Moreover, frequent reporting to a supervisory authority about its financial position is substantially more difficult for an MFI that specializes in very small transactions than for other financial intermediaries such as banks (Christen *et al.*, 2003).

A second reason why the costs of compliance with prudential regulation might be especially onerous for microfinance institutions stems from the high share of skilled labor costs involved. Studies indicate that most of the costs of complying with new banking regulations in industrialized countries are for labor (Elliehausen & Kurtz, 1988; Elliehausen & Lowery, 1995; Schroeder, 1985), and a substantial component of those labor costs are managerial and legal expenses—to monitor

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employee compliance, coordinate compliance reviews with regulators, and keep abreast of regulatory changes, regulator interpretations, and court decisions (Elliehausen, 1998). Such skilled labor is likely to be in short supply in many MFIs and costly to acquire. Even the less skilled administrative work associated with preparing regular reports for supervisors is likely to be done in headquarters, which could mean less staff in the field working directly with clients.

Third, microlending inherently involves making small loans to large numbers of borrowers. Because the administrative costs per dollar lent are much higher for small loans than for large ones, the interest rates necessary to cover all costs (including costs of funds and loan losses) are much higher for MFI loans than for conventional bank loans. Fortunately, the returns to capital can also be high for small, capital-starved businesses, and so high interest rates can be paid (see, e.g., De Mel, McKenzie, & Woodruff, 2006; McKenzie and Woodruff, 2007). At the same time, any factor that causes costs to go up, including the costs associated with complying with prudential regulation, is likely to force MFIs to raise either interest rates or loan sizes to maintain the same level of profitability. Increases on either dimension could result in the exclusion of some potential borrowers.

We investigate the impact of prudential regulation on the profitability and financial self-sustainability of microfinance institutions, with an eye on the channels through which impacts work. For example, if profit-oriented MFIs find ways to absorb the costs of prudential regulation that leave their profits unchanged, it would be of interest to see whether these costs are absorbed by changing the business orientation and curtailing outreach to smaller borrowers and women because reaching those market segments can be costlier per dollar lent. We also examine whether prudential regulation reduces the share of employees who work in the field. Finally, if prudential regulation imposes costs, we also need to investigate what those costs buy. In particular, we look at whether regulation is associated with improved loan quality.

These issues have been under-studied largely due to lack of data. We build on a subset of the MixMarket dataset, which provides unusually high-quality financial information for a broad range of institutions world-wide. The data we use cover 346 institutions in 67 countries, most from 2003 or 2004 (the 2008 round, collected in volume 17 of the *Microbanking Bulletin*, includes 1406 institutions). The MFIs included in the MixMarket are among the largest in the world, and their willingness to submit their financial information to the Microfinance Information eXchange, Inc. (MIX) indicates a commitment to achieving financial self-sufficiency. We expect that these would be the MFIs best positioned to absorb the costs of prudential regulation. If we find evidence of trade-offs associated with such regulation in this group of MFIs, we expect that the effects would be even more pronounced for smaller institutions not included in our database.

Most MFIs face some form of non-prudential regulation. These regulations can include rules governing MFI formation and operations, consumer protection, fraud prevention, establishing credit information services, secured transactions, interest rate limits, foreign ownership limitations, and tax and accounting issues (Christen *et al.*, 2003). Prudential regulations are less common and are imposed when system-wide concerns are justified or protecting small depositors is an issue.

Previous research on microfinance regulation and prudential supervision focuses on the relationship between financial performance and regulation, treating outreach as a secondary concern. Hartarska (2005) finds that regulated MFIs in Central and Eastern Europe and the Newly Independent States have lower return on assets relative to others, and weak evidence that the breadth of outreach may be related to regulation. After controlling for the endogeneity of regulation, Hartarska and Nadolnyak (2007) find that regulation has no impact on financial performance and weak evidence that regulated MFIs serve less poor borrowers. Mersland and Strøm (2009) use an endogenous equations approach to find that regulation does not have a significant impact on financial or social performance, where regulation is measured by a regulation dummy variable.

These previous efforts to study the effect of regulation are based on a binary regulation indicator variable. Based on information from the MIX database collected for the *Microbanking Bulletin* publication, which we cross-referenced with information from other sites, we construct a measure of whether an MFI faces prudential regulation of the sort described in Christen *et al.* (2003). We construct two variables that are the focus of the analysis, a dummy variable equal to one if an MFI faces onsite supervision, and another equal to one if that supervision occurs at regular intervals. Within the same country, we find that some MFIs face onsite supervision while others do not, depending on their ownership structure, funding sources, activities, and organizational charter. To our knowledge, this is the first dataset that allows for within-country variation regarding MFI regulation and supervision. The results highlight the role of the enforcement of regulation, and not just whether laws are on the books or not.

Our results suggest that microfinance institutions subjected to more regular—and presumably more rigorous—supervision are not less profitable compared to others despite the higher costs of supervision. We also observe that this type of supervision is associated with larger average loan sizes and less lending to women, hence indicating a reduced outreach to segments of the population that are costlier to serve. We also find that controlling for the non-random assignment of supervision is important in obtaining these results.

Lacking time series data on MFIs' performance before and after supervision, our empirical strategy is to start with a rough classification of the extent to which MFIs in our sample are profit-oriented based on their sources of funding. We hypothesize that greater reliance on commercial sources (like deposits) than on non-commercial sources (like donations) would lead an MFI to be more profit-oriented. While it is true that commercially funded (profit oriented) MFIs tend to be supervised more often than non-commercially funded ones, there is still variation in supervision within each group. This is the variation we exploit in the paper: we compare the supervised with the unsupervised MFIs in each sub-group (commercially oriented and non-commercially oriented). We argue that this is a fair test because MFIs in the commercially funded group are facing similar incentives to make profits. Similarly, the MFIs that are not commercially funded face weaker incentives to be profitable, so comparing the supervised and unsupervised within that group is also a fair test.

The rest of the paper is organized as follows. In Section 2 we describe our data and present the relationships between MFI characteristics (e.g., size and lending methodology), MFI performance (profitability and outreach), and our regulatory variables. Those relationships help to form the profiles for regulated *versus* un-regulated MFIs. Because the profiles in Section 2 indicate strongly that the assignment of regulation and supervision to MFIs is non-random, we discuss estimation techniques that can account for selection effects in Section 3. We present regression results in Section 4, robustness checks based on split-sample tests in Section 5, and offer concluding remarks in Section 6.

2. DATA

The analysis relies on data from 346 microfinance institutions (MFIs) in 67 developing countries that were collected by the Microfinance Information eXchange (or the MIX), a not-for-profit private organization that aims to promote information exchange in the microfinance industry. [1] There are 540 observations in our database because some MFIs report information for multiple years. In the regressions that follow, we use only the most recent observation from each MFI because the error terms from observations from the same MFI are likely to be correlated, leading to an artificial reduction in the standard errors of the estimated coefficients. Qualitative results are similar when we include all observations in the regressions and cluster standard errors at the MFI level. All but one of the most recent observations are from 2003 or 2004. [2]

Participation by microfinance institutions in the MIX is voluntary, and thus the sample is skewed toward institutions that have stressed financial objectives and profitability. These institutions also tend to be large by the standard of MFIs, covering 16.1 million active microfinance borrowers with a combined total of $2.8 billion in assets. Most of the clients (10 million) are found in the top 20 largest institutions. Honohan (2004) finds that the largest 30 MFIs account for more than three-quarters of the customers of 2,572 MFIs that report to the Microcredit Summit. While we cannot be certain, it seems highly likely that our sample covers a significant proportion of the customers in that database. The relatively large, profitable MFIs in our dataset are likely to be in the best position to absorb the costs of prudential supervision. If we find evidence that they decrease outreach to help absorb those costs, we would presume that the smaller MFIs not covered in our dataset would face even more severe tensions.

The data are collected for publication in the *Microbanking Bulletin* (MBB) and have been adjusted to help ensure comparability across institutions when measuring profitability. [3] In addition to standard entries from the balance sheet and income statements, the dataset contains qualitative information on the lending style employed by the MFI (group *versus* individual-based lending), the range of services it offers, its profit status, ownership structure, charter status, and sources of funds. Many of these serve as important controls in the regressions that follow.

The key variables in the analysis summarize whether an MFI faces prudential supervision. As already pointed out, most MFIs face some form of non-prudential regulation, and thus it is not surprising that the average for the regulatory dummy variable that is included in the *MBB* and our dataset is 0.85 (Table 1). [4] It also comes as no surprise that, due to its uniformity, the simple regulation variable cannot explain substantial variation in MFI profitability or outreach. What is needed is a variable that better summarizes variation in the cost of complying with regulation. Toward that end, we offer three dummy variables indicating whether (1) an MFI faces a regular reporting requirement to a regulatory authority; (2) the MFI faces onsite supervision; and (3) onsite supervision occurs at regular intervals. Because MFIs that face onsite

Table 1. *Regulatory variables*

				Observations			Mean
Panel A: Summary statistics							
Regulation (from MBB database)				225			0.85
Regular reporting (constructed here)				220			0.68
Onsite supervision (constructed here)				245			0.51
Regular onsite supervision (constructed here)				244			0.38
Country	Obs	Onsite supervision (%)	Regular onsite supervision (%)	Country	Obs	Onsite supervision (%)	Regular onsite supervision (%)
Panel B: Distribution by country and region, selected variables							
Albania	2	100	50	Kenya	2	100	50
Armenia	5	0	0	Kyrgyz Republic	1	100	0
Azerbaijan	3	0	0	Malawi	2	0	0
Bangladesh	4	0	0	Mexico	4	75	0
Bolivia	9	100	22	Mongolia	1	100	100
Bosnia and Herz.	10	0	0	Nepal	1	100	0
Brazil	5*	20	0	Nicaragua	10	10	0
Bulgaria	2	0	0	Pakistan	14	0	0
Ecuador	16	100	100	Peru	24	63	63
Egypt, Arab Rep.	3	0	0	Philippines	24	38	38
El Salvador	3	100	0	Russian Federation	15	73	0
Ethiopia	15	100	100	Serbia and Montenegro	3	0	0
Georgia	6	0	0	South Africa	1	100	0
Ghana	18	67	67	Tajikistan	2	100	0
India	7	100	100	Tanzania	5	20	20
Indonesia	12	92	92	Thailand	1	0	0
Jordan	4	0	0	Uganda	8	63	13
Kazakhstan	2	0	0	Ukraine	1	0	0

Region	Obs	Region	Obs
East Asia & Pacific	38	Middle East & North Africa	7
Europe & Central Asia	52	South Asia	26
Latin America & Caribbean	71*	Sub-Saharan Africa	51

* One less observation for regular onsite supervision.

supervision also have a regular reporting requirement to supervisory authorities, the set of MFIs under supervision are a subset of those with reporting requirements. Similarly, MFIs that face regular onsite supervision are a subset of those that face any onsite supervision. Moving from the least to the most stringent type of supervision, 68% of our sample have a reporting requirement, 51% face onsite supervision, and 38% face onsite supervision at regularly scheduled intervals.

To construct our regulatory variables, we use the legal (or charter) status of each MFI. That variable classifies institutions into one of five types: banks, rural banks, credit unions and cooperatives, non-bank financial institutions (NBFIs), and non-governmental organizations (NGOs). We then looked at the description of the regulation faced by MFIs for each country as described on the MIX website. A quick perusal of those country pages indicates that the stringency of regulation faced by MFIs within a given country often depends on their legal status. In instances when we could not determine whether an institutional type faced a reporting requirement, onsite supervision, or regular onsite supervision from the MIX regulatory descriptions, we checked the websites of the regulatory authorities themselves. In the end we were able to obtain data for the onsite supervision variables for 245 MFIs, and 220 MFIs for the reporting requirement variable. Table 1 also provides statistics at the country level for the shares of MFIs facing onsite supervision and regular onsite supervision. The regional composition of the sample is provided at the bottom of the table.

Comparing the characteristics of supervised and unsupervised institutions indicates strongly that the assignment of prudential supervision is non-random. In Table 2, we compare MFIs that face onsite supervision with those that do not because that regulatory variable splits our sample roughly in half. More detailed descriptions of the distributions and construction of all of the variables used in the analysis are found in Appendix A. Christen *et al.* (2003) argue that prudential supervision should be triggered when an MFI accepts retail deposits from the public and in our sample 74% of those that accept deposits face onsite supervision compared with only 14% for those that do not accept deposits. A much higher share of those with onsite supervision are non-NGOs that lend to individuals (rather than groups), make larger loans, lend less to women, and have a higher share of staff concentrated in the head office (and thus fewer staff with contact with clients in the field). Supervised MFIs also tend to be larger (in terms of assets), and a bit older and more profitable (in terms of Financial Self Sufficiency) than unsupervised MFIs. However, these differences are not significant for total assets or FSS. The profile that emerges is that more commercially-oriented MFIs tend to be supervised, while the more outreach-oriented MFIs are not.

These summary statistics foreshadow our main regression results. Namely, while there is no significant difference in profitability, there is significantly less outreach (larger loan sizes and less lending to women) for supervised MFIs than unsupervised ones. These simple statistics are, therefore, also

Table 2. *Sample comparison, supervised versus unsupervised MFIs*

Variable	Faces onsite supervision	Does not face onsite supervision	Difference in means *(t test significance at 95 CI)*
NGO dummy	0.112	0.76	Yes
	(0.31)	(0.42)	
	Obs. 125	Obs. 120	
Accepts deposits dummy	0.74	0.14	Yes
	(0.43)	(0.35)	
	Obs. 124	Obs. 120	
Individual-based lender	0.51	0.2	Yes
	(0.50)	(0.40)	
	Obs. 125	Obs. 120	
Total assets ($US millions)	55.0	10.1	No
	(317.0)	(36.2)	
	Obs. 117	Obs. 113	
Financial self-sufficiency	1.05	1.01	No
	(0.31)	(0.37)	
	Obs. 113	Obs. 115	
Age	11.32	8.71	Yes
	(9.3)	(4.96)	
	Obs. 125	Obs. 120	
Average loan size	3.3	1.35	Yes
(relative to *per capita* income of bottom quartile)	(4.9)	(2.55)	
	Obs. 125	Obs. 117	
% Women borrowers	63.59%	73.1%	Yes
	(27.4%)	(29.4%)	
	Obs. 84	Obs. 118	
% of Staff in head office	45.7%	32.5%	Yes
	(40.0%)	(32.4%)	
	Obs. 68	Obs.96	
% of Staff that are loan officers	52.1%	58.7%	Yes
	(18.8%)	(14.5%)	
	Obs. 120	Obs.119	
Operating expenses/gross loan portfolio	21.7%	38.8%	No
	(20.8%)	(117.1%)	
	Obs. 124	Obs. 119	

consistent with the idea that supervised MFIs are compelled to curtail outreach to maintain profitability.

Operating expense ratios for supervised institutions tend to be lower than for the unsupervised. At first blush this might seem to contradict an important part of our story, namely that complying with regulation and supervision is costly for MFIs. However, operating expense ratios tend to be higher for institutions that make smaller loans and lend more to women precisely because those market segments are harder to reach (Cull, Demirgüç-Kunt, & Morduch, 2007; Cull, Demirgüç-Kunt, & Morduch, 2009; Gonzalez, 2007). Table 2 therefore, indicates that the costs of complying with onsite supervision are not large enough to push the cost profiles of the more commercially-oriented MFIs beyond those of the outreach-oriented MFIs. Yet this does not necessarily indicate that the costs of complying with supervision are negligible or that commercially-oriented MFIs do not seek to defray those costs by making larger loans and lending less to women. In any event, the operating cost levels for the two groups are not significantly different from one another.

3. ESTIMATION TECHNIQUE

Estimating the effects of regulation and supervision on MFI outreach and profitability calls for a technique that can account for the non-random assignment of supervision highlighted in the prior section. We opt for treatment effects regression which considers the effect on an endogenously chosen binary treatment (in this case, the choice to regulate and supervise an MFI) on another endogenous continuous variable (in this case, indicators of MFI profitability and outreach), conditional on two sets of independent variables. The first set of independent variables is used to estimate a selection equation that describes the supervisory choice. Information from the selection equation is then used in the financial development regression. The key difficulty is in finding an appropriate set of exogenous variables for use in the selection equation. As a check on our results, we also offer instrumental variables regressions.

In many Heckman-type selection models, the dependent variable is observable only for those individuals (or households or MFIs) that received the treatment. In this analysis, indicators of profitability and outreach are observable for MFIs that do and do not face supervision. Treatment effects models are, therefore, estimated in which:

$$Y_i = \alpha + \beta X_i + \delta Z_i + \varepsilon_i, \tag{1}$$

where Y is an indicator of profitability or outreach and X is a matrix of control variables describing an MFI's size, lending technology, business orientation, and region. Z is the endogenous treatment variable indicating whether or not MFI i faces supervision. As is typical in this literature, the decision to supervise is modeled as the outcome of an unobserved latent variable Z^*, which is a function of exogenous covariates W and a random component u:

$$Z_i^* = \gamma W_i + u_i. \tag{2}$$

The researcher observes:

$$\begin{aligned} &Z_i = 1, \text{ if } Z_i^* > 0, \\ &Z_i = 0, \text{ otherwise.} \end{aligned} \tag{3}$$

Because the selection of MFIs for supervision is non-random, and because the error term of the model that summarizes this choice (namely, 2) could be correlated with the error term in the regression of interest (namely, 1), one must search for a set of valid instruments. These instruments should be highly correlated with the endogenous regressor (the supervisory dummy), but contemporaneously uncorrelated with the error term in (1) (i.e., truly exogenous).

We use three variables as instruments in the regressions that follow. The first is a dummy variable indicating whether large and medium-sized banks have annual (or more frequent) onsite supervision ("*Big Bank Supervision*"). The variable is based on survey responses from bank supervisors in more than one hundred countries that were collected by Barth, Caprio, and Levine (2006). [5] We view this variable as a measure of a country's general propensity to regulate the banking industry. [6] In countries with a high propensity to regulate banks, we expect that MFIs will also be more likely to face regulation and supervision. The variable is exogenous in that the propensity to regulate banks existed before the MFIs arrived. Even had MFIs and large banks arrived contemporaneously, it is highly unlikely that the regulation of MFIs would have influenced regulation of banks, owing to the small size of the MFIs.

As a robustness check on our main results, we replace the *Big Bank Supervision* dummy variable with an index of the official powers of bank supervisors, also developed by Barth *et al.* (2006). That index, which is described in detail in Appendix B, is based on 12 questions about the powers granted to supervisors in monitoring and disciplining banks. Though the qualitative results of those models are similar to those that use *Big Bank Supervision* as an instrument, we have 40% fewer observations for the *Official Supervisory Powers* ("*OS*") index, and thus significance levels tend to be lower, model convergence is sometimes problematic, and excludability is harder to demonstrate. [7] To conserve space, we do not present those results below.

Because the *Big Bank Supervision* dummy variable and the *OS* index do not explain sufficient variation in the assignment of supervision, neither can serve as the only instrument in our regressions. [8] In part, this is because both are country-level variables and, as discussed above, there is substantial within-country variation in the types of MFIs that face supervision. We also, therefore, need instruments that provide MFI-specific information.

Our first MFI-level instrument is a dummy variable indicating whether each MFI is organized as a non-governmental organization (NGO) or a non-bank financial institution (NBFI). MFIs with NGO/NBFI charters tend to have objectives and funding arrangements that differ from those of more commercially-oriented MFIs (such as banks or credit unions). In particular, NGO/NBFI-based MFIs place greater emphasis on outreach and rely relatively heavily on donated funds to subsidize those efforts (Cull *et al.*, 2009). Because NGO-based MFIs were designed to be somewhat less commercially-oriented from their inception, we expect that there would be less need for supervision aimed at ensuring the quality of their asset portfolios. [9]

In the regressions, we use a dummy variable indicating that an MFI was not organized as a NGO/NBFI (*non-NGO/NBFI status*) as an instrument. We recognize that our grouping is somewhat arbitrary in that we are lumping together banks, cooperatives, and credit unions and differences in their organizational structures might give rise to different incentives. However, we have relatively few cooperatives and credit unions in the sample and the results of the regressions are very similar when they are dropped. [10] As expected, *non-NGO/NBFI status* is strongly positively linked to our primary supervisory dummy variable, onsite supervision at regular intervals (correlation .40, p-value 0.000). Because charter status was determined at

the outset of the creation of each MFI, prior to and without substantial consideration for whether the MFI would face supervision, *non-NGO/NBFI status* can be viewed as exogenous. In some specifications, we interact *non-NGO/NBFI status* with the *Big Bank Supervision* variable or the *OS index*.[11] The intuition behind the interaction is that supervision should be especially likely for non-NGO/NBFI MFIs located in countries where the general propensity to regulate and supervise providers of financial services is high.

As noted by Christen *et al.* (2003), prudential supervision should generally be triggered when an MFI accepts retail deposits from the general public so as to safeguard the savings of relatively poor depositors. We, therefore, use a dummy variable indicating whether an MFI accepts retail deposits (*savings dummy)* as our second MFI-level instrument.[12] Like *non-NGO/NBFI status*, we presume that the decision to accept deposits was, in most instances, taken at the outset of the creation of the MFI. Also similar to *non-NGO/NBFI status*, we interact the *savings dummy* with the *Big Banks Supervision* variable and the *OS index*. MFIs that accept deposits and operate in countries with a high propensity to regulate should be among those most likely to face supervision.[13]

Most of the control variables in the X matrix in Eqn. (1) are the same as those used in other studies of MFI performance and outreach (Ahlin and Lin, 2006; Cull *et al.,* 2007). One new variable is *Premium*, the difference between the interest rates an MFI charges its borrowers and the rate it pays on its own liabilities. The interest rate charged on loans equals total interest revenue divided by the gross loan portfolio. Because loan losses are not netted out of the interest revenues, this measure is intended to capture the *ex ante* interest rate charged by the lender rather than the *ex post* interest rate realized on the portfolio. Interest paid on liabilities equals total interest payments divided by commercial liabilities. All else equal, a higher premium is presumably associated with greater profitability.

Eqn. (1) also includes *labor costs* and *capital costs*, both measured relative to total assets.[14] Both variables should be negatively associated with profitability. *Solidarity* is a dummy variable equal to one if an MFI makes joint liability loans to solidarity groups. Loans are made to individuals, but the group, which has between 3 and 10 members depending on the institution and location, shoulders responsibility for a loan if a member cannot repay. *Village Bank* is a dummy variable equal to one if the MFI does village banking, where each branch forms a single, large group and is given a degree of self-governance (this kind of arrangement was pioneered by FINCA and is now employed by organizations like Pro Mujer and Freedom from Hunger). MFIs that make standard bilateral loans to individuals (the so-called *individual-based* lenders), therefore, form the omitted category in our regressions.

Table 3. *The effect of regulatory supervision on MFI financial self-sustainability (FSS)*

	Dependent variable: FSS			
	OLS (White SE)	Treatment effects	IV	Treatment effects
Regular onsite supervision	−0.176***	−0.045	0.078	0.007
	(3.60)	(0.53)	(0.70)	(0.06)
Premium	0.808***	0.733***	0.738***	0.745***
	(3.83)	(3.54)	(3.63)	(3.59)
Capital costs to assets	−1.477***	−1.315***	−1.158**	−1.330***
	(3.56)	(2.66)	(2.50)	(2.68)
Labor costs to assets	−1.684***	−1.754***	−1.525***	−1.740
	(4.91)	(4.12)	(4.23)	(4.08)
Village bank	0.055	0.102*	0.152***	0.104*
	(1.12)	(1.80)	(2.69)	(1.82)
Solidarity	−0.055	−0.031	−0.006	−0.030
	(1.34)	(0.466)	(0.15)	(0.70)
Average loan size	0.003	0.001	0.009	0.001
	(0.40)	(0.14)	(1.19)	(0.13)
Size indicator	0.004	−0.0001	−0.019	−0.008
	(0.13)	(0.04)	(0.65)	(0.23)
Log of age	0.029	0.047	0.048	0.041
	(0.75)	(1.38)	(1.37)	(1.19)
Observations	167	154	154	154
R^2	0.3799			
Prob > chi		0.0000		0.0000
Prob > F	0.000		0.0000	
LR test of independent equations: Prob > chi		0.2607		0.2527
Anderson LR statistic (identification/IV relevance): Chi-sq P-val			0.0000	
Excludability				
Instrument		Non-NBFI/NGO × Big banks supervision	Non-NBFI/NGO × Big banks supervision	Savings Dummy × Big banks supervision
Significant in OLS?		$P = 0.743$	$P = 0.743$	$P = 0.311$

Notes: The regressions also include inflation, real GDP growth, the KKM measure of institutional development, regional dummy variables, and a constant. Observations where premium, FSS, or average loan size (relative to the bottom quintile) ranked above the 99th or below the 1st percentile are dropped from the regressions. Rural banks are also excluded from the sample. The excludability test is based on an OLS regression in which the instrument replaces the regular onsite supervision variable. The hope is that the coefficient on the instrument is insignificant, and thus it can be viewed as excludable. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level respectively.

Additional MFI-level controls include *Age* (measured in years since inception), *Size* (as measured by total assets), and *Average Loan Size* (relative to GNP *per capita)*. We expect all three variables to be positively linked to MFI profitability—age and size because they reflect how well established the MFI is, and average loan size because making relatively large loans to fewer customers is likely to be more efficient than making large numbers of small loans (as discussed above). The size indicator is also included to control for economies of scale that larger MFIs might enjoy.

Country-level control variables include *Inflation*, real *GDP Growth*, and a measure of broad institutional development created by Kaufmann, Kraay, and Mastruzzi (2007). We expect the *KKM Institutional Development* and *GDP Growth* variables to be positively linked to MFI profitability, and *Inflation* to have a negative relationship. Finally, *region* is a matrix of dummy variables for each main region of the developing world, with "Latin America and the Caribbean" as the omitted category.

4. RESULTS: OLS *VERSUS* TREATMENT EFFECTS REGRESSIONS

Due to the non-random assignment of supervision to MFIs discussed in Section 2, this section highlights the differences in results from estimation techniques that account for selection effects (treatment effects and IV regressions) with those from one that does not (OLS). We discuss regressions that explain profitability, outreach, and staffing in separate sub-sections.

(a) *Profitability*

The OLS regression in Table 3 (model 1) indicates that, as expected, there is a negative relationship between Financial Self-Sufficiency (FSS) and our supervisory variables.[15] We use FSS instead of operational self-sufficiency (OSS), another commonly used measure of MFI performance, because FSS better incorporates making a return on capital that is market related and commensurate with the risks involved.[16] Thus, the additional costs of complying with prudential supervision are associated with reduced financial self-sufficiency. Significance levels and the magnitudes of some coefficients are slightly higher for the regular onsite supervision dummy variable than for the simple onsite supervision variable, a pattern consistent with regular supervision being more stringent, and thus costlier. The associations are also economically large: MFIs facing regular onsite supervision have FSS levels .18 lower than other MFIs. The sample mean for FSS is 1.03. Because the qualitative results for the simple onsite dummy and the regular onsite dummy are so similar, we report results only for the regular onsite supervision variable in the tables to conserve space.

When we control for the non-random assignment of prudential supervision via treatment effects and IV regression (models 2–4 in Table 3), there is no significant relationship between the supervision variables and FSS. This suggests that those MFIs that are both outreach-oriented and supervised cannot or do not adjust to the increase in costs imposed by supervision, and are driving the negative significant coefficient for supervision in the OLS regression. On the flip side, the treatment effects and IV regressions suggest that the profit-oriented MFIs that are likely to be selected for supervision find ways to maintain their profitability. Below we test whether those methods include making larger loans and lending less to women. Although our instruments are all highly significant in the selection equations and of the sign that we predicted, we cannot reject the hypothesis that the errors for the selection equation are uncorrelated with those for the FSS regression based on the likelihood ratio test near the bottom of the treatment effects regressions.[17] Both of the instruments used in Table 3 are excludable in that they are not significant when they replace the supervision variable in the simple OLS regression.

Regarding the control variables in the FSS regressions, the interest premium is positive and highly significant across all specifications. Labor and capital costs are negative and significant across specifications. None of the additional MFI-level controls (age, size, average loan size) is significant. However, village banks tend to have higher FSS in some of the treatment effects and IV regressions.

Inflation is negative and significant in most regressions, in line with findings from Ahlin and Lin (2006) that the macroeconomic context is a key determinant of MFI performance.[18] Like those authors, we also find that real growth is positive and more highly correlated with FSS than inflation. As hypothesized, the *KKM* measure of institutional development is positive and significant in three of the regressions.

Qualitative results are similar for regressions in Table 4 where the dependent variable is return on assets (ROA).[19] Again, the supervision variables are negative and significant in the OLS regression, but insignificant in the treatment effects and IV regressions. The results for the control variables are similar to those for the FSS regressions, although the inflation coefficient is no longer significant and the growth variable tends to be less significant. The ROA regressions indicate more strongly than the FSS regressions that profitability is lower for MFIs located in Sub-Saharan Africa, East Asia, and the Middle East and North Africa. The instruments are again excludable in that they are not significant when included in the simple OLS regressions. We again cannot reject the hypothesis that the errors for the selection equation are uncorrelated with those for the ROA regression based on the likelihood ratio test near the bottom of the treatment effects regressions.

(b) *Outreach*

In the previous sub-section we found no significant relationship between supervision and MFI profitability when we controlled for the non-random assignment of supervision via treatment effects or IV regressions. Here we test whether MFIs maintain profitability while absorbing the additional costs of supervision by curtailing outreach, specifically whether they make larger loans and fewer loans to women.

In the OLS regression in Table 5, the supervisory variable is negatively associated with average loan size measured relative to the income of the bottom quintile in each country, though the result is not significant. As in the profitability regressions, results change when we account for the non-random assignment of supervision using treatment effects or IV regressions (models 2–4). Those regressions indicate a positive link between supervision and loan size (significant in models 2 and 3).[20] The magnitude of the supervisory coefficients is also quite large. Regular onsite supervision is associated with increases in loan sizes almost two times the average income of the lowest quintile in model 2. Coefficients are even larger in the IV regression (model 3).[21]

Comparisons between the OLS and treatment effects regressions suggest that those MFIs that are both outreach-oriented and supervised are driving the negative, nearly significant coefficient between supervision and average loan size in the OLS regression. Finally, our instruments are all highly significant in the selection equations and of the sign that we predicted,

Table 4. *The effect of regulatory supervision on MFI adjusted return on assets*

	Dependent variable: ROA			
	OLS (white SE)	Treatment effects	IV	Treatment effects
Regular onsite supervision	−0.058***	−0.026	0.005	0.0007
	(5.07)	(1.14)	(0.19)	(0.02)
Premium	0.337***	0.347***	0.348***	0.353***
	(4.96)	(6.56)	(4.85)	(6.54)
Capital costs to assets	−0.433***	−0.452***	−0.411***	−0.463***
	(3.25)	(3.57)	(2.58)	(3.59)
Labor costs to assets	−0.761***	−0.818***	−0.756***	−0.820***
	(4.71)	(7.52)	(4.83)	(7.43)
Village bank	0.006	0.016	0.029	0.017
	(0.38)	(1.12)	(1.38)	(1.18)
Solidarity	0.007	0.010	0.017	0.011
	(0.55)	(0.98)	(1.16)	(1.02)
Average loan size	0.001	0.0003	0.002	0.00004
	(0.37)	(0.13)	(1.35)	(0.02)
Size indicator	0.001	−0.002	−0.007	−0.005
	(1.42)	(0.27)	(0.91)	(0.52)
Log of age	−0.004	−0.001	−0.001	−0.003
	(0.47)	(0.19)	(0.17)	(0.42)
Observations	167	154	154	154
R^2	0.5069		0.4879	
Prob > chi		0.0000		0.0000
Prob > *F*	0.0000		0.0000	
LR test of independent equations: Prob > chi		0.2634		0.2050
Anderson LR statistic (identification/ IV relevance): Chi-sq *P*-val			0.0000	
Excludability				
Instrument		Non-NBFI/NGO × Big banks supervision	Non-NBFI/NGO × Big banks supervision	Savings dummy × Big banks supervision
Significant in OLS?		$P = 0.417$	$P = 0.417$	$P = 0.538$

Notes: The regressions also include inflation, real GDP growth, the KKM measure of institutional development, regional dummy variables, and a constant. Observations where premium, adjusted ROA, or average loan size (relative to the bottom quintile) ranked above the 99th or below the 1st percentile are dropped from the regressions. Rural banks are also excluded from the sample. The excludability test is based on an OLS regression in which the instrument replaces the regular onsite supervision variable. The hope is that the coefficient on the instrument is insignificant, and thus it can be viewed as excludable. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level respectively.

and we can reject the hypothesis that the errors for the selection equation are uncorrelated with those for the average loan size regression based on the likelihood ratio test near the bottom of the treatment effects regressions. Thus, some adjustment for the non-random assignment of supervision is necessary.

Excludability of our instruments is, however, a somewhat thornier issue for the average loan size regressions than it was in the profitability regressions. For example, the interaction between the *savings dummy* and *big banks' supervision* is significant in the simple OLS regression at the $p = .01$ level, indicating that it is unsuitable for use as an instrument. The interaction between *non-NGO/NBFI* and *big banks' supervision* is insignificant, but the *p*-value is a bit too close for comfort (.12). However, recognizing that excludability is a problem in the average loans size regressions, there are some in which the problem is less severe, and the results support the notion that profit-oriented MFIs that face onsite supervision extend substantially larger loans than those that do not face supervision.

Results for the control variables in Table 5 are different than in the profitability regressions. The MFI size indicator, based on total assets, is strongly positively associated with larger loan size. Premium is negative and highly significant indicating that MFIs require a wider margin between lending and borrowing interest rates to make small loans. All else equal, village banks and, to a lesser extent, solidarity group lenders tend to extend smaller loans. Regional dummies also play a more important role in the loan size regressions than in the profitability regressions. Negative significant coefficients for many regions indicate that loan sizes tend to be larger in Latin America and the Caribbean, the omitted region in the regressions. Coefficients for the other regions indicate that loan sizes are smallest in Eastern Europe and Central Asia, South Asia, and the Middle East and North Africa.

The results for the share of lending to women provide strong support for the notion that profit-oriented MFIs that face onsite supervision curtail outreach (Table 6). In the OLS regression, there is a negative relationship between onsite supervision and the share of lending to women. In the treatment effects and IV regressions, there is also a significant negative relationship between supervision and lending to women, but the coefficients are much larger (in absolute value) than in the OLS regression. Again, our instruments are significant in the selection equations and of the sign that we predicted. Moreover, none of our instruments are significant (at the $p = .10$ level) when they replace the supervision variable in the OLS regression, which indicates that they are excludable,

Table 5. *The effect of regulatory supervision on MFI average loan size (relative to income of bottom quintile)*

	Dependent variable: average loan size/income *per capita* of bottom quartile			
	OLS (white SE)	Treatment effects	IV	Treatment effects
Regular onsite supervision	−1.072	1.751***	4.293*	0.952
	(1.55)	(2.85)	(1.73)	(1.02)
Premium	−7.191***	−7.498***	−8.681***	−7.007***
	(3.91)	(4.63)	(3.42)	(3.72)
Capital costs to assets	−2.827	−0.032	2.469	−1.792
	(0.94)	(0.01)	(0.51)	(0.38)
Labor costs to assets	1.247	2.792	8.956*	2.066
	(0.41)	(0.78)	(1.77)	(0.51)
Village bank	−1.215***	−1.058**	−0.156	−1.303**
	(3.76)	(2.14)	(0.22)	(2.41)
Solidarity	−0.625	−0.549	0.163	−0.445
	(1.53)	(1.45)	(0.27)	(1.09)
Size indicator	1.251***	1.041***	1.080**	1.198***
	(3.41)	(3.21)	(2.13)	(3.50)
Log of age	−0.181	0.163	0.013	−0.112
	(0.69)	(0.52)	(0.04)	(0.34)
Observations	167	154	154	154
R^2	0.3811		0.3586	
Prob > chi		0.0000		0.0000
Prob > *F*	0.0000		0.0000	
LR test of independent equations: Prob > chi		0.0000		0.004
Anderson LR statistic (identification/ IV relevance): Chi-sq *P*-val			0.0000	
Excludability				
Instrument		Non-NBFI/NGO × Big banks supervision	Non-NBFI/NGO × Big banks supervision	Savings dummy × Big banks supervision
Significant in OLS?		$P = 0.121$	$P = 0.121$	$P = 0.001$

Notes: The regressions also include inflation, real GDP growth, the KKM measure of institutional development, regional dummy variables, and a constant. Observations where premium, FSS, or average loan size (relative to the bottom quintile) ranked above the 99th or below the 1st percentile are dropped from the regressions. Rural banks are also excluded from the sample. The excludability test is based on an OLS regression in which the instrument replaces the regular onsite supervision variable. The hope is that the coefficient on the instrument is insignificant, and thus it can be viewed as excludable. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level respectively.

though the *p*-value is .11 for one of them. For model 2, which uses *big banks' supervision x non-NGO/NBFI* as an instrument, we can also reject (at the $p = .05$ level) the hypothesis that the errors from the selection equation are uncorrelated with those from the share of lending to women regression based on the likelihood ratio test near the bottom of the treatment effects regressions.

The relative importance of the control variables is different in the women's lending share regressions than in the average loan size regressions. MFI size is not significantly associated with the share of lending to women. However, lending method is important; solidarity group lenders and village banks devote 7–20% points more of their loans to women than do individual-based lenders based on the coefficients in Table 6. The premium variable is also highly significant indicating that the interest rates charged on loans to women are relatively high. Finally, the share of lending to women tends to be higher for MFIs in South Asia than those in other regions. In all, the results for both average loan size and the share of lending to women indicate that, once we control for its non-random assignment, prudential supervision is associated with less outreach.

(c) *Staffing*

As noted in the introduction, the administrative work associated with preparing regular reports for supervisors is likely to be done in headquarters resulting in less staff working directly with clients in the field. To test that proposition, we use the percentage of staff located in headquarters as a dependent variable in the regressions in Table 7. We find that regular onsite supervision is positively associated with the share of staff located in headquarters. In the treatment effects and IV regressions, that relationship is even stronger.

Though the results point in the predicted direction, we must acknowledge that we cannot reject the hypothesis that the errors from the selection equation and the % headquarters staff equation are independent based on the likelihood ratio for the treatment effects regressions, and *big banks' supervision* × *non-NGO/NBFI* is significant in the OLS regression, indicating that it is an unsuitable instrument. However, the regressions provide some evidence consistent with the idea that supervised firms re-deploy personnel away from the field to comply with regulation. This re-deployment could also contribute to reduced outreach.

As a final exercise, we used the share of the loan portfolio that was delinquent at least thirty days as a dependent variable. Though our results to this point are consistent with the idea that prudential supervision imposes costs on MFIs, it might also be true that it helps ensure the safety of deposits, which could be an important goal given that MFIs tend to have small depositors as customers. In OLS regressions, the relationship between regular onsite supervision and delinquent portfolio share is positive and significant, indicating perhaps

Table 6. *The effect of regulatory supervision on fraction of borrowers that are women*

	Dependent variable: fraction women borrowers			
	OLS (white SE)	Treatment effects	IV	Treatment effects
Regular onsite supervision	−0.172***	−0.320***	−0.366***	−0.350***
	(3.01)	(3.56)	(2.56)	(2.22)
Premium	0.507***	0.530***	0.557***	0.525***
	(2.77)	(2.90)	(2.66)	(2.80)
Capital costs to assets	0.072	0.015	−0.102	0.035
	(0.17)	(0.03)	(0.21)	(0.07)
Labor costs to assets	−0.272	−0.1038	−0.495	−0.154
	(0.62)	(0.24)	(1.06)	(0.35)
Village bank	0.159***	0.189***	0.177***	0.195***
	(2.89)	(3.79)	(3.16)	(3.75)
Solidarity	0.070*	0.085**	0.071	0.087**
	(1.72)	(2.10)	(1.60)	(2.14)
Size indicator	−0.017	−0.0005	−0.004	−0.003
	(0.54)	(0.02)	(0.14)	(0.10)
Log of age	0.003	0.009	0.001	0.009
	(0.08)	(0.28)	(0.04)	(0.26)
Observations	134	121	121	121
R^2	0.4265		0.3795	
Prob > chi		0.0000		
Prob > *F*	0.0000		0.0000	
LR test of independent equations: Prob > chi		0.0438		0.6157
Anderson LR statistic (identification/ IV relevance): Chi-sq *P*-val			0.0000	
Excludability				
Instrument		Non-NBFI/NGO × Big banks supervision	Non-NBFI/NGO × Big banks supervision	Savings dummy × Big banks supervision
Significant in OLS?		$P = 0.111$	$P = 0.111$	$P = 0.306$

Notes: The regressions also include inflation, real GDP growth, the KKM measure of institutional development, regional dummy variables, and a constant. Observations where premium, FSS, or average loan size (relative to the bottom quintile) ranked above the 99th or below the 1st percentile are dropped from the regressions. Rural banks are also excluded from the sample. The excludability test is based on an OLS regression in which the instrument replaces the regular onsite supervision variable. The hope is that the coefficient on the instrument is insignificant, and thus it can be viewed as excludable. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level respectively.

that supervised MFIs tend to take on more credit risk than others. In the treatment effects and IV regressions, the delinquent portfolio share variable is no longer significant, suggesting that prudential supervision can contribute to improved portfolio quality. However, data from only 37 MFIs enter those regressions, which pass neither the simple excludability test nor the likelihood ratio test indicating that the errors from the selection equation and the equation of interest are independent. We do not, therefore, present those results in the tables and are reluctant to draw conclusions about the stability benefits of the prudential supervision, which is a topic better left to future research.

5. SPLIT-SAMPLE ROBUSTNESS CHECKS

The ideal empirical test would involve otherwise identical MFIs; some subjected to prudential supervision, others not. In practice, such an experiment is not possible, and thus the treatment effects regressions are designed to approximate it. The differences between the OLS and treatment effects regressions in the previous section provide an indication that supervision has a causal effect on the trade-off between profitability and outreach. For a number of those regressions our instruments also satisfy standard statistical tests of excludability. Still, one cannot help but worry that the treatment effects and IV regressions are picking up a distinction between types of MFIs. Those with a relatively high-profitability, low-outreach profile might also tend to be supervised. Supervision might just be a part of, rather than a cause of, the profile.

To address that concern, this section offers tests that split our sample so that we can compare the supervised and unsupervised within a group of MFIs that are similar on non-supervisory dimensions. We use the "non-commercial funding ratio" to split our sample. That ratio is zero if all funds come from either commercial borrowing or deposit-taking. The ratio is 1 if the institution draws funds from neither source, instead relying on donations, borrowing at below-market interest rates (i.e., subsidized loans) or equity.[22] In a companion paper, we find that MFIs with similar non-commercial funding ratios also tend to have similar profitability and outreach profiles (Cull *et al.*, 2009). We conjecture that higher shares of non-commercial funding coincide with softer budget constraints, and greater pursuit of outreach at the expense of profitability. By grouping MFIs with similar funding profiles, therefore, we are comparing the effects of prudential supervision for MFIs with similar objectives and incentives.

Table 8, panel A offers summary statistics for our dependent variables for commercial organizations, MFIs with non-commercial funding ratios <50%. If our story is correct, we would expect supervised firms in this group to maintain profitability while absorbing the costs of supervision by curtailing outreach. Table 8 shows no significant difference in the average profitability (FSS or Adjusted ROA) of commercial MFIs that

Table 7. *The effect of regulatory supervision on MFI staff concentration*

	Dependent variable: staff concentration			
	OLS (white SE)	Treatment effects	IV	Treatment effects
Regular onsite supervision	0.158*	0.321***	0.321**	0.388***
	(1.85)	(2.81)	(2.25)	(2.82)
Premium	−0.629*	−0.306	−0.315	−0.320
	(1.87)	(1.09)	(1.30)	(1.15)
Capital costs to assets	1.041	0.613	0.620	0.572
	(1.39)	(0.97)	(1.14)	(0.90)
Labor costs to assets	−0.826	−0.181**	−1.136***	−1.146**
	(1.16)	(2.08)	(3.49)	(2.02)
Village bank	−0.070	−0.005	−0.004	−0.005
	(0.96)	(0.08)	(0.08)	(0.08)
Solidarity	−0.118*	−0.036	−0.037	−0.035
	(1.86)	(0.68)	(0.77)	(0.69)
Size indicator	−0.159***	−0.173***	−0.175***	−0.174***
	(2.71)	(3.71)	(3.49)	(3.77)
Log of age	−0.513	−0.033	−0.031	−0.040
	(1.15)	(0.85)	(1.01)	(1.00)
Observations	101	92	92	92
R^2	0.5210		0.7306	
Prob > chi		0.0000		0.0000
Prob > *F*	0.0000		0.0000	
LR test of independent equations: Prob > chi		0.7263		0.375
Anderson LR statistic (identification/IV relevance): Chi-sq *P*-val			0.0000	
Excludability				
Instrument		Non-NBFI/NGO × Big banks supervision	Non-NBFI/NGO × Big banks supervision	Savings dummy × Big banks supervision
Significant in OLS?		$P = 0.028$	$P = 0.028$	$P = 0.182$

Notes: The regressions also include inflation, real GDP growth, the KKM measure of institutional development, regional dummy variables, and a constant. Observations where premium, FSS, or average loan size (relative to the bottom quintile) ranked above the 99th or below the 1st percentile are dropped from the regressions. Rural banks are also excluded from the sample. The excludability test is based on an OLS regression in which the instrument replaces the regular onsite supervision variable. The hope is that the coefficient on the instrument is insignificant, and thus it can be viewed as excludable. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level respectively.

face onsite supervision and those that do not.[23] By contrast, the average outreach of commercial MFIs that face onsite supervision is significantly less than that of those that do not. The difference is also reflected in simple correlation coefficients between onsite supervision and outreach measures: 0.23 ($p = .014$) for average loan size; −0.38 ($p = .0003$) for share of women borrowers; and 0.44 ($p = .0003$) for the share of staff located in headquarters. Within a group of relatively homogeneous MFIs that have strong incentives to be profitable, we, therefore, find evidence consistent with the notion that supervised MFIs maintain a profitability level similar to unsupervised ones by curtailing outreach.

By contrast, within the group of non-commercially oriented MFIs (those with non-commercial funding ratios $\geqslant 50\%$), we would expect that absorbing the costs of supervision would be less likely to result in reduced outreach. And in fact, Table 8, panel B shows no significant difference in average loan size, share of women borrowers, or share of staff in headquarters for supervised and un-supervised non-commercial MFIs. We would, however, expect the costs of supervision to be reflected in reduced profitability. Supervised non-commercial MFIs do in fact have lower average FSS than the unsupervised (0.86 *versus* 1.00), though the difference is not quite significant at conventional levels. The simple correlation between supervision and FSS for non-commercial MFIs is −0.19 ($p = .07$) for the regular onsite supervision variable and −0.14 ($p = .19$) for onsite supervision. There are not, however, any significant relationships between the supervisory variables and adjusted ROA for this group of MFIs. Despite a somewhat weak relationship between supervision and profitability, the results in panel B are broadly consistent with our story: supervised non-commercial MFIs do not tend to have poorer outreach than unsupervised ones, and there is some evidence that they are less profitable.

Grouping MFIs by the non-commercial funding ratio is a reasonable, albeit rough method for examining the effects of supervision within a relatively homogeneous pool. However, within the group of commercial (or non-commercial) MFIs, supervised institutions might have systematically different characteristics (size, age, lending methodology) than the unsupervised, which could be driving the differences in means that we found in Table 8. We, therefore, regress each of our dependent variables on the supervision variable and all of the other control variables from the base regressions (Tables 3–7). To be consistent with the base regressions, we use the regular onsite supervision variable in Table 9, though results are qualitatively similar for the onsite supervision variable.

For non-commercial MFIs (bottom row of coefficients) regular onsite supervision is not significant in the average loan size, women borrowers, or headquarters staff specifications. Supervision is, however, strongly negatively linked to FSS and adjusted ROA, much more so than in the simple bi-variate calculations. For commercial MFIs, supervision is significant and negative in the women borrowers' regression, and signifi-

Table 8. *Sample comparison of commercial organizations[*] (panel A) and non-commercial organizations[*] (panel B), supervised versus unsupervised MFIs*

Variable	Faces onsite supervision	Does not face onsite supervision	Difference in means (*t test significance at 95 CI*)
Panel A			
Financial self-sufficiency	1.114	1.082	No
	(0.289)	(0.34)	
	Obs.86	Obs.34	
Adjusted return on assets	0.016	0.005	No
	(.047)	(0.094)	
	Obs.84	Obs.33	
Average loan size (relative to *per capita* income of bottom quartile)	3.638	1.325	Yes
	(5.571)	(1.885)	
	Obs.89	Obs.34	
% Women borrowers	0.650	0.854	Yes
	(0.287)	(0.197)	
	Obs.59	Obs.34	
% of Staff in head office	0.507	0.178	Yes
	(0.432)	(0.141)	
	Obs.51	Obs.24	
Panel B			
Financial self-sufficiency	0.863	1.004	No
	(0.358)	(0.434)	
	Obs.20	Obs.71	
Adjusted return on assets	−0.047	−0.042	No
	(0.134)	(0.225)	
	Obs.19	Obs.70	
Average loan size (relative to *per capita* income of bottom quartile)	1.869	1.420	No
	(1.067)	(3.011)	
	Obs.21	Obs.70	
% Women borrowers	0.602	0.686	No
	(0.231)	(0.310)	
	Obs.14	Obs.71	
% Staff in head office	0.287	0.389	No
	(0.165)	(0.378)	
	Obs. 10	Obs.59	

[*] All MFI's that have a non-commercial funding ratio of 50% or greater are classified as non-commercial organizations. The others are classified as commercial organizations. Standard deviations are in parentheses.

Table 9. *Split-sample regressions*

	Financial self-sufficiency ratio (1)	Adjusted return on assets (2)	Average loan size/income at 20th percentile (3)	% of Borrowers that are women (4)	% of Staff located in head-quarters (5)
Sample: non-commercial funding ratio <.5					
Regular onsite supervision	−0.096	−0.046***	−1.852	−0.190***	0.225**
	[0.06]	[0.01]	[1.20]	[0.06]	[0.10]
Observations	93	93	95	68	50
R^2	0.35	0.52	0.44	0.59	0.80
Sample: non-commercial funding ratio ⩾.5					
Regular onsite supervision	−0.527****	−0.157***	−0.226	−0.123	0.031
	[0.12]	[0.03]	[0.62]	[0.11]	[0.13]
Observations	68	68	71	63	51
R^2	0.71	0.76	0.45	0.50	0.43

Notes: The regressions also include interest rate premium, capital and labor costs (relative to assets), MFI size and age, dummy variables for village bank and solidarity group lender, inflation, real GDP growth, the KKM measure of institutional development, regional dummy variables, and a constant. Standard errors are in parentheses. Observations where premium, FSS, or average loan size (relative to the bottom quintile) ranked above the 99th or below the 1st percentile are dropped from the regressions. Rural banks are also excluded from the sample. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level respectively.

cant and positive in the percentage of staff in headquarters regression, results which reinforce the relationships suggested by Table 8. The supervision variable is not, however, significant in the average loan size regression. Supervision is insignificant for commercial MFIs in the FSS regression, also consistent with the bi-variate calculations. Supervision is negative and significant in the ROA regression for commercial MFIs, but much smaller (in absolute value) than for non-commercial MFIs. This indicates that supervised commercial MFIs are more successful in maintaining their ROA than

supervised non-commercial MFIs, which is also consistent with our story. By and large, the results from the split-sample tests confirm those from our base regressions.

6. CONCLUSIONS

To date, there has been relatively little discussion, at least within academic circles, and almost no empirical analysis of the effects that prudential supervision is likely to have on MFI profitability and outreach. To address these issues, we combine high-quality balance sheet and income statement data for 245 leading MFIs with a newly constructed database of the type of supervision that each faces.

Strong patterns emerge from the supervisory data indicating that its assignment is non-random. Specifically, supervision tends to be more stringent for commercially-oriented MFIs, non-NGOs that collect deposits from the public, lend to individuals (rather than groups), make larger loans, have proportionately fewer female customers, and have a higher share of staff concentrated in the head office (and thus fewer staff with contact with clients in the field).

Searching for appropriate instrumental variables is of course difficult because many of the characteristics that define supervised MFIs are likely to be endogenous in profitability and outreach regressions. We, therefore, offer three instruments for use in treatment effects and IV regressions that have bearing on whether an MFI is regulated but do not directly affect MFI performance. The first is the general propensity to supervise formal financial institutions in a country as reflected in a dummy variable indicating whether large banks face onsite supervision at regular intervals. The second is a dummy indicating that an MFI was not chartered as an NGO or NBFI, since charter status was determined at the outset of the creation of each MFI, prior to and without substantial consideration for whether the MFI would face supervision. Similarly, our third instrument is a dummy indicating whether an MFI takes deposits, because that decision was also presumably taken at the inception of the MFI in most cases.

The selection stage of our treatment effects regressions confirms that non-NGO/NBFI's that take deposits and are located in countries that supervise large banks at regular intervals are most likely to face onsite supervision at regular intervals. Controlling for the non-random assignment via those instruments, we find that regular onsite supervision is positively associated with average loan size and negatively associated with the share of lending to women. Though onsite supervision is negatively associated with profitability in OLS regressions, we find no significant relationship between supervision and profitability in treatment effects or IV regressions. The pattern of results is consistent with the idea that profit-oriented MFIs that have to comply with prudential supervision respond by curtailing their outreach to segments of the population that are costlier to serve.[24] By contrast, MFIs that rely on non-commercial sources of funding (e.g., donations), and thus are less profit-oriented, do not adjust loan sizes or lend less to women when supervised, but their profitability is significantly reduced. Split sample tests based on the share of funding that an MFI receives from non-commercial sources confirm this pattern. Though these results are intuitive from an economic perspective, it remains an open question whether the benefits of supervision in terms of better protection of depositors' funds and improved stability in the MFI sector outweigh the reductions in outreach.

NOTES

1. This is a substantial increase over the MIX database used in Cull *et al.* (2007), which contained information from 124 MFIs in 49 countries. That dataset was a variant of the so-called MBB 9 database. In this paper, we use a variant of the MBB 10 database.

2. We have one observation from 2002, 50 from 2003, and 194 from 2004.

3. These include adjustments for inflation, the cost of subsidized funding, current-year cash donations to cover operating expenses, donated goods and services, write-offs, loan loss reserves and provisioning, a reclassification of some long-term liabilities as equity, and the reversal of any interest income accrued on non-performing loans.

4. The institutions included in MicroBanking Bulletin data tend to be larger and more profitable than the broader set of MFIs included in Mixmarket data. This difference could account for why 85% of MFIs are regulated in our data while only 67% are regulated in Hartarska and Nadolnyak (2007), for example.

5. We use the 2003 version of that dataset because it corresponds most closely to the years covered in our data.

6. One might worry that regulation and supervision is more stringent in better developed financial systems, and thus our supervisory dummies reflect financial development more than a propensity to regulate. However, when we control for measures of financial development in our treatment effects regressions, qualitative results are almost identical to those presented below.

7. Hartarska and Nadolnyak (2007) confront similar difficulties when using this variable as an instrument.

8. The correlation between *Big Bank Supervision* and the regular onsite supervision variable is only 0.05 (p-value 0.411). The correlation between the *OS* index and regular onsite supervision is 0.21 (p-value 0.004), but again that variable covers far fewer countries.

9. We recognize that some NBFIs are more commercially oriented than others. In robustness checks that we do not report, we split the NBFIs, grouping those with non-profit charter status with NGOs, and those with for-profit charters with banks and credit unions. Results are qualitatively similar to those presented below. When we dropped all NBFIs from the sample, we obtained somewhat similar results, though the loss of so many observations reduced significance levels.

10. Dropping credit unions and cooperatives from the regressions reduces the sample by only 8–13 observations depending on the specification. Credit unions and cooperatives are mutuals with an objective to achieve operational sustainability (returning any surplus to members), rather than seeking profit in order to remunerate shareholders as in the case of private banks. Regression results for the sample that excludes the credit unions and cooperatives are available from the authors.

11. The correlation between *non-NGO/NBFI status*Big Bank Supervision* and regular onsite supervision is 0.51 (p-value 0.000). The correlation between *non-NGO/NBFI status*OS index* and regular onsite supervisions is 0.43 (p-value 0.000).

12. The correlation between the savings dummy and regular onsite supervision is 0.49 (p-value 0.000).

13. The correlation between *Savings*Big Banks Supervision* and regular onsite supervision is 0.44 (p-value 0.000). The correlation between *Savings*OS index* and regular onsite supervision is 0.48 (p-value 0.000).

14. Capital costs are measured as: (rent + transportation + depreciation + office expenses + other expenses)/total assets. Labor costs are: personnel expenses/total assets.

15. We drop rural banks from the sample in all of the regressions that we present. The profile of the rural banks provides strong indications that they are not like other banks or credit unions. All face regular onsite supervision, yet 86% of their borrowers are women and their average loan size is 1.7 times the *per capita* GDP of the bottom quintile, which is similar to that for un-supervised MFIs (see Table 2). They are also larger (average size category 2.2) and older (36.3 years) than most MFIs in the sample, and all are located in a single country, the Philippines. Qualitative results are not however substantially different when we include rural banks in the sample. It is unfortunate that we do not have a wider sample of rural banks since these are precisely the prudentially supervised MFIs that are likely to be reaching the poorest clients.

16. By contrast operational self-sufficiency is more concerned with covering costs and, perhaps, generating some surplus.

17. Since all of the instruments are highly significant in the selection equation, we do not present them in the tables so as to conserve space.

18. Coefficients for the macroeconomic controls and the regional dummies are also suppressed in the tables to make them more readable. The full specifications are available from the authors.

19. Like the FSS variable, the income portion of the ROA variable is adjusted to reflect a variety of subsidies. Those subsidies are described in Appendix C.

20. MFI performance measures are from 2003 or 2004, essentially a cross-section. The stringency of supervision and regulation data is based on information from the MIX website from 2007 (and other sources, when that one proved insufficient). We acknowledge that this could produce some weakness in the results (as in models 3 and 4 in Table 5), though we find it unlikely that a large share of the MFIs in the sample were changing their supervisory status during this period. In any event, we have no way to check. The Barth, Caprio, and Levine data (used for the big banks' supervision variable and index of official supervisory powers) are also cross-sectional and more or less contemporaneous with the MFI performance data, so we are less concerned that there is a major problem, though we acknowledge that if the performance effects of supervision show up at a lag, results might be weak.

21. Results are also similar when we replace average loan size relative to the income of the bottom quintile with average loan size relative to income *per capita* as the dependent variable in the regressions.

22. The "non-commercial funding ratio" is defined as (donations + non-commercial borrowing + equity) divided by total funds. Here, donations are defined as: donated equity from prior years + donations to subsidize financial services + an in-kind subsidy adjustment. Equity is the sum of paid-in capital, reserves, and other equity accounts; it does not include retained earnings or net income. Commercial borrowing refers to borrowing at commercial interest rates (though in practice it can be hard to determine where the market would set those rates). Non-commercial borrowing, in parallel, is borrowing at concessional interest rates (with the same caveat as above). Total funds are the sum of donations, equity, deposits (both savings and time deposits), commercial borrowing, and non-commercial borrowing.

23. As in Table 2, we use the onsite supervision variable in Table 8 because it provides a more balanced split of the sample.

24. Again, we note that these results do not pertain to rural banks since our sample included so few of them and all were from the same country. This is unfortunate since these are precisely the prudentially supervised MFIs that are likely to be reaching the poorest clients. This is clearly a promising area for further research.

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APPENDIX A. VARIABLE DESCRIPTION AND SUMMARY STATISTICS

Variable name	Definition	Mean	Median	Minimum	Maximum
Financial self-sufficiency	Adjusted operating revenue/Adjusted (financial expense + loan loss provision expense + operating expense)	1.030	1.035	−0.595	2.622
Return on assets adjusted	Adjusted net operating income after taxes/Average total assets	−0.018	0.008	−1.658	0.413
Average loan size to GNP *per capita* of the poorest 20%		2.160	1.269	.00002	37.777
Women borrowers (%)	Percentage of borrowers who are women.	0.690	0.718	0.001	1.0
Staff concentration at home office	Fraction of total staff based at the home office.	0.285	0.211	0.001	0.983
Loan officers (%)	Fraction of total staff that have direct contact with the clients.	0.547	0.545	0.062	1.0
Real gross portfolio yield	(Yield on gross portfolio (nominal) − Inflation rate)/ (1 + Inflation rate)	0.222	0.201	−0.133	0.949
Premium	Real yield − Real Interest Rate Charged to Prime Lenders	0.170	0.147	−0.212	0.803
Annual big bank onsite supervision	Dummy = 1 if "How frequently are onsite inspections conducted in large and medium size banks?" is annual or more frequent.	0.755	1	0	1
Non- (NBFI/NGO)	Dummy for Organizations that are not Classified as NGO's or NBFI's	0.257	0	0	1
Savings dummy	Equal to 1 if the MFI accepts Voluntary Deposits	0.421	0	0	1
Age	Age of the MFI in years	10.485	8	0	48
Size of MFI indicator	Size of the loan portfolio, which is 1 for small, 2 for medium and 3 for large.	2.491	3	1	3
Village bank lender	The MFI does village bank style lending (as opposed to MFIs who do individual lending or solidarity lending).	0 .161	0	0	1
Solidarity lender	The MFI does some solidarity style lending (as opposed to MFIs who do only individual lending or do village bank lending).	0.572	1	0	1
Capital costs to assets	(Rent + transportation + depreciation + office + other)/total assets	0.0822	0.064	0.004	0.392
Labor costs to assets	Personnel expenses/total assets	0.101	0.078	0.005	0.461
KKM	Governance Index (Kaufmann et al)	−0.489	−0.450	−1.587	1.245
Real GDPgr (%)		5.863	5.611	−3.094	17.854
Inflation		8.734	6.223	−4.567	51.461
Eastern Europe and Central Asia		0.187	0	0	1
Africa		0.213	0	0	1
Middle East and North Africa		0.057	0	0	1
South Asia		0.075	0	0	1
East Asia and the Pacific		0.161	0	0	1

APPENDIX B INDEX OF OFFICIAL SUPERVISORY POWERS

The questions that are used to calculate the index of official supervisory powers are:

1. Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank?
2. Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud or insider abuse?
3. Can supervisors take legal action against external auditors for negligence?
4. Can the supervisory authority force a bank to change its internal organizational structure?
5. Are off-balance sheet items disclosed to supervisors?
6. Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses?
7. Can the supervisory agency suspend the directors' decision to distribute dividends?
8. Can the supervisory agency suspend the directors' decision to distribute bonuses?
9. Can the supervisory agency suspend the directors' decision to distribute management fees?
10. Who can legally declare—such that this declaration supersedes the rights of shareholders—that a bank is insolvent? (A) bank supervisor; (B) court; (C) deposit insurance agency; (D) bank restructuring or asset management agency; (E) other.
11. According to the Banking Law, who has authority to intervene—that is, suspend some or all ownership rights—a problem bank? (A) bank supervisor; (B) court; (C) deposit insurance agency; (D) bank restructuring or asset management agency; (E) other.
12. Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency supersede shareholder rights or remove and replace management or directors? (A) bank supervisor; (B) court; (C) deposit insurance agency; (D) bank restructuring or asset management agency; (E) other.

For questions 1–9: Yes = 1: No = 0.

For questions 10–12: Bank supervisor = 1: Deposit insurance agency = 0.5; Bank restructuring or asset management agency = 0; 0 otherwise.

The official supervisory powers index is constructed as the sum of these assigned values, with higher values indicating greater power.

Source: Barth *et al.* (2006)

APPENDIX C. FINANCIAL STATEMENT ADJUSTMENTS AND THEIR EFFECTS

Adjustment	Effect on financial statements	Type of institution most affected by adjustment
Inflation adjustment of equity (minus net fixed assets)	Increases financial expense accounts on income statement, to some degree offset by inflation income account for revaluation of fixed assets. Generates a reserve in the balance sheet's equity account, reflecting that portion of the MFI's retained earnings that has been consumed by the effects of inflation. Decreases profitability and "real" retained earnings.	MFIs funded more by equity than by liabilities will be hardest hit, especially in high-inflation countries
Reclassification of certain long-term liabilities into equity, and subsequent inflation adjustment	Decreases concessionary loan account and increases equity account; increases inflation adjustment on income statement and balance sheet.	NGOs that have long-term low-interest "loans" from international agencies that function more as donations than loans
Subsidized cost of funds adjustment.	Increases financial expense on income statement to the extent that the MFI's liabilities carry a below-market rate of interest. Decreases net income and increases subsidy adjustment account on balance sheet.	MFIs with heavily subsidized loans (i.e., large lines of credit from governments or international agencies at highly subsidized rates)
Subsidy adjustment: current-year cash donations to cover operating expenses	Reduces operating expense on income statement (if the MFI records donations as operating income). Increases subsidy adjustment account on balance sheet.	NGOs during their start-up phase. The adjustment is relatively less important for mature institutions.
In-kind subsidy adjustment (e.g., donation of goods or services: line staff paid for by technical assistance providers)	Increases operating expense on income statement to the extent that the MFI is receiving subsidized or donated goods or services. Decreases net income, increases subsidy adjustment on balance sheet.	MFIs using goods or services for which they are not paying a market-based cost (i.e., MFIs during their start-up phase)

(*Continued on next page*)

APPENDIX C—(*Continued*)

Adjustment	Effect on financial statements	Type of institution most affected by adjustment
Loan loss reserve and provision expense adjustment	Usually increases loan loss provision expense on income statement and loan loss reserve on balance sheet.	MFIs that have unrealistic loan loss provisioning policies
Write-off adjustment	On balance sheet, reduces gross loan portfolio and loan loss reserve by an equal amount, so that neither the net loan portfolio nor the income statement is affected. Improves (lowers) portfolio-at-risk ratio.	MFIs that do not write off non-performing loans aggressively enough.
Reversal of interest income accrued on non-performing loans	Reduces financial income and net profit on the income statement, and equity on the balance sheet.	MFIs that continue accruing income on delinquent loans past the point where collection becomes unlikely, or that fail to reverse previously accrued income on such loans

Source: *The Microbanking Bulletin, Our Methodology* (www.mixmbb.org/en/company/our_methodology.html).