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Capital adjustment over the cycle: Evidence from microfinance institutions

By Issouf Soumaré, Hubert Tchakoute Tchuigoua, and Hélyoth T.S. Hessou

SOAS University of London

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Centre for Global Finance
SOAS University of London
10 Thornhaugh Street, Russell Square
London
WC1H 0XG

Email: cgf@soas.ac.uk
Website: https://www.soas.ac.uk/centreforglobalfinance/publications/

Capital adjustment over the cycle: Evidence from microfinance institutions*

Issouf Soumaré
Laboratory for Financial Engineering of Laval University
Department of Finance, Insurance and Real Estate
Faculty of Business Administration
Laval University, Quebec, Canada
Email: issouf.soumare@fsa.ulaval.ca

Hubert Tchakoute Tchuigoua
Department of Accounting, Finance and Accounting
Kedge Business School, France
Email: hubert.tchakoute@kedgebs.com

Hélyoth T.S. Hessou
Department of Finance, Insurance and Real Estate
Faculty of Business Administration
Laval University, Quebec, Canada
Email: helyoth.hessou.1@ulaval.ca

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Capital adjustment over the cycle: Evidence from microfinance institutions

Abstract

Using a sample of 5996 firm-year observations from 1414 MFIs worldwide over the 2001-2014 period, we uncover a negative relationship between MFIs' capital-to-assets ratios and business and credit cycle indicators. This relationship mainly concerns regulated MFIs, comprised mostly of bank-MFIs, and is largely driven by asset-side adjustment rather than variations in their capital level. This finding is consistent with the "procyclicality" of capital regulation documented extensively in the banking literature. For pro-poor NGO-MFIs, the business cycle has no significant impact on their capital adjustment; this is due to the nature of their clientele, who are poor and vulnerable, and more typically operate in the informal sector, and are therefore less affected by macroeconomic shocks. Our findings are robust to various model specifications and alternative estimation techniques. Hence, in regulating MFIs, policymakers have to keep in mind that a one-size-fits-all policy does not work. Indeed, a countercyclical buffer requirement similar to Basel III may be imposed on regulated MFIs, while for non-regulated MFIs, which are less involved in mainstream finance and less sophisticated in their risk management practice, imposing this type of requirement may impact their lending behavior toward the unbanked.

Keywords: Microfinance, capital, business cycle

JEL Code: G21

1. Introduction

Capital regulation is considered as one of the most effective way to constrain banks' excessive risk taking and ensure a stable financial system. However, the benefit of capital regulation does not come at zero cost. There is evidence that a higher capital requirement can amplify real sector instability due to the so-called procyclical behavior of capital ratios; e.g., Ayuso et al. (2004), Behn et al. (2016), Bikker and Metzemakers (2007), Boar et al. (2017), Guidara et al. (2013), Jokipii and Milne (2008), Lindquist (2004), Repullo and Suarez (2012), Shim (2013), Stolz and Wedow (2011), among many others. Indeed, during crisis when capital is scarce and costly, banks subject to minimum capital requirement(s) may be forced to shrink their assets (through loan rationing) to meet capital adequacy requirements. The effect is even stronger when the existing capital is quickly depleted by losses incurred during the crisis, which additionally exacerbates the economic downturn. To counter this procyclical effect of capital regulation, the revised Basel Accords (known as Basel III) have introduced a countercyclical capital buffer to urge banks to raise their capital during booms (excessive credit growth period) so that they can enter stress times with better capitalization (BCBS, 2011 and 2017). Yet, these policies are primarily designed for banks, and less attention has been paid to capital regulation of microfinance institutions (MFIs) which play a major financial intermediary role in developing and emerging economies by serving unbanked and vulnerable people. To the best of our knowledge, the relationship between the business/credit cycle and MFIs' capital ratios has not yet been studied in the literature.

The objective of our study is thus to investigate the capital adjustment behavior of hybrid organizations such as MFIs with respect to business and credit cycles. More specifically, we aim to examine the balance sheet channel (asset-side versus liability-side) through which MFIs adjust their capital ratio depending on their ownership type and their regulation status. Analysis of the cyclical behavior of MFIs' capital can be motivated by at least three reasons. First, the level of capitalization of microfinance institutions is of paramount importance for inclusive growth and financial stability. Indeed, MFIs are non-

negligible financial intermediaries in the financial system of less developed countries (LDCs) and emerging economies. Unlike banks, they are better suited to dealing with the information asymmetries which undermine the credit market in LDCs, and are efficient in dealing with micro-loan costs. While banks are reluctant to grant uncollateralized loans in low-income communities in LDCs, hopefully, there are many MFIs providing valuable financial services in limited amounts to low income people and small and informal businesses. These services are mainly in the form of uncollateralized microloans or microloans with unconventional collateral under various institutional forms, and through different types of lending methodologies.[1] Small and informal business activities are less affected by the boom-bust cycle. However, the current trends towards the commercialization of microfinance are associated with both a) the so-called microfinance mission drift, that is, the fact that MFIs increasingly cater to wealthier customers who are better off than their original customers, and b) the shift from joint liability contracts to individual loan contracts preferred by wealthier clients (Lutzenkirchen and Weistroffer, 2012). As the composition of the MFIs' client portfolios evolved as a result of commercialization, it is likely that their wealthier clients will be affected by macroeconomic shocks and disruptions with implications for their activities.

Second, MFIs' financing policy appears to be one of the channels through which financial crises can affect MFIs and their behavior. There is a strong belief in the literature (e.g., Brière and Szafarz, 2015; Galema et al., 2011) that microfinance and the financial sector are highly correlated. Indeed, given the maturity of the microfinance sector, MFIs are now an integral part of the financial system of most developing countries in which they compete with banks especially through up-scaling strategies (Brière and Szafarz, 2015; Cull et al., 2014; Vanroose and d'Espallier, 2013) and as such are likely to suffer from macroeconomic shocks. Additionally, the lack of short-term resources, coupled with

[1] The proven success of microfinance in financial inclusion and in alleviating poverty is now recognized and evidenced (Reed, 2015). According to the 2015 Microcredit Summit report, the total number of customers served by MFIs worldwide grew continuously between 1997 and 2013. As of December 31, 2013, 3,098 microfinance institutions (MFIs) reported reaching 211,119,547 borrowers, 114 million of whom were living in extreme poverty. Of these poorest clients, 82.6% are women.

the fact that domestic credit markets are underdeveloped in some countries, limits MFIs' financial market access. To overcome this constraint, MFIs seek commercial sources of funding, local or cross-border, in order to meet their aspiration to alleviate poverty. Moving toward commercialization, by use of market funding, may increase the ability of MFIs to expand their scale by leveraging assets (Armendariz and Morduch, 2010). The Consultative Group to Assist the Poor (CGAP) (2011) survey suggests that cross-border funding enables MFIs to diversify their external funding sources. Between 2007 and 2010, foreign investment in microfinance (including both debt and equity) quadrupled to reach US$ 24 billion. In addition, some MFIs fund themselves directly through financial markets (e.g., Equity Bank in Kenya and Compartamos Banco in Mexico).

Third, and finally, there is clear evidence in the literature that losses and defaults are higher during recessions and profits are low (Murcia and Kohlscheen, 2016). Therefore, it is desirable for MFIs to hold enough capital through the business cycle so that they can continue to offer valuable services during stress periods. Considering that regulators worldwide are working to ensure a stable financial system, from both micro and macro perspectives, an understanding of capital management in MFIs throughout the business cycle will provide valuable insights for policymakers and regulators in their effort to extend or adapt the revised Basel regulation, for financial institutions operating outside the formal banking sector and for more financial inclusion.

However, while the banking literature has extensively investigated the link between capital and the business cycle, little is known about economic/credit cycle effects on MFIs' capital. The existing banking literature is divergent on the determinants of the level of bank capital. Some studies document that incentives to maintain a higher capital ratio come from regulatory pressure (so-called regulatory hypothesis). A capital buffer serves as a cushion against failures to meet capital requirements (Linquidst, 2004) and, in countries that apply prompt corrective actions more actively, banks maintain higher capital ratios to comply with capital adequacy requirements (Brewer et al., 2008). Other studies consider that market discipline may explain why banks hold a positive level of

excess capital. Indeed, recent studies show that market forces coming from the asset side of the balance sheet, especially moral hazard resulting from competition, gives incentives to banks to maintain a higher level of equity (Allen et al., 2011; Martinez-Miera and Repullo, 2010; Schaeck and Cihàk, 2012). Although many studies have investigated banks' capital adjustment behavior, studies that directly investigate the determinants of the level of capital in microfinance institutions remain scant. Among the few that exist, some of them provide a picture of the relationship between MFIs' capital structure and their institutional life cycle and maturity (de Sousa-Shields and Frankiewicz, 2004; Ledgerwood and White, 2006). Bogan (2012) and D'Espallier et al. (2013) link the capital structure of MFIs and their financial performance. Some other studies focus on the disciplinary effect of capital and find no significant effect of capital ratios on MFIs' institutional rating (Gutiérrez-Nieto and Serrano-Cinca, 2007; Tchakoute Tchuigoua, 2013).

To date, to our knowledge, Tchakoute Tchuigoua (2016) is the only study that directly focuses on capital determinants in MFIs, by examining the impact of competition on MFIs' capital buffer. In that paper, there was no specific variable in the model to capture the business cycle effect. As we claim above, the recent banking literature has extensively documented a non-negligible effect of business cycle on bank capital. Unfortunately, this has not been the case in the microfinance literature. Our study therefore extends upon Tchakoute Tchuigoua (2016) by examining whether MFIs adjust their capital ratio over the business cycle, especially profited-oriented MFIs and MFIs that are subject to prudential regulation. We also add to the banking literature since, to our knowledge, very few papers have investigated the relationship between capital and business cycles in banks and microfinance institutions in less developed economies. Given the fact that MFIs can be considered as development banks in developing economies, our study also contributes to the literature on the cyclical behavior of bank capital with a focus on organizations belonging to the field of development finance.

Furthermore, recent studies on international data of MFIs focus on how macroeconomic factors affect MFIs' financial performance. To date, some anecdotal

evidence provided by microfinance practitioners supports the assumption that MFIs are resilient to economic crisis, suggesting that MFIs' performance is at most weakly correlated with domestic macroeconomic conditions (Chen et al., 2010; Lutzenkirchen and Weistroffer, 2012). On the contrary, other recent microfinance empirical studies provide opposite evidence. They document that correlation between vulnerability/crisis in microfinance and the global economic crisis does exist (e.g., Wagner, 2012; Wagner and Winkler, 2013). These latter authors examine the effect of financial crisis on MFIs credit growth and documented the drop in MFIs lending during the 2008-2009 global financial crisis. Wijesiri (2016) assesses the impact of the global financial crisis on the performance of different microfinance ownership types. Using efficiency measures of performance, the author finds that profit-oriented MFIs (banks and non-bank financial institutions (NBFIs)) that performed better immediately before the crisis, suffered more during the crisis and early post-crisis periods. Non-profit MFIs, such as cooperatives and credit unions (Coop/CU-MFIs) and non-governmental organizations (NGO-MFIs), on the other hand, were less affected by the crisis. Ahlin et al. (2011) show that macroeconomic and institution-specific factors are important determinants of MFIs' performance. The above literature focuses on the effect of the crisis on MFIs' loan portfolios, on MFIs' accounting performance, and on their efficiency. As stressed above, during the crisis period, MFIs, especially profit-oriented and regulated ones, faced sharp declines in both credit growth and capital inflows, similar to traditional banks. These results suggest that some types of MFIs may be more vulnerable to macroeconomic shocks and thus may be better off adjusting their capital in a countercyclical manner as recommended by the Basel III regulation for banks.

In this context, we therefore supplement previous studies by answering the following unexplored research questions in the microfinance literature: (1) How do MFIs adjust the level of their capital ratio through the business and credit cycles? In other words, are MFIs' capital ratio adjustments procyclical or countercyclical? (2) Is this procyclical or countercyclical adjustment behavior consistent across different microfinance ownership types (profit-oriented versus non-profit-oriented) and regulation status (regulated versus

non-regulated)? (3) What are the balance sheet channels (asset-side versus liability-side) through which the capital ratio adjustment occurred? By answering these questions, we contribute to the debate on the effects of macroeconomic conditions on MFIs and extend upon Ahlin et al. (2011), Wagner (2012), Wagner and Winkler (2013) and Wijesiri (2016). We also contribute to the existing microfinance literature on observed differential behavior among MFIs with respect to their ownership type and regulation status by investigating the effect of macroeconomic conditions on their respective equity ratios. Moreover, our study covers a longer period than previous studies, and as opposed to Ahlin et al. (2011) and Wagner and Winkler (2013), we use the partial adjustment framework, which accounts for the fact that MFIs may gradually adjust their capital ratios over time.

Using a sample of 5996 firm-year observations from 1414 MFIs worldwide over 2001-2014, we find a negative co-movement between MFIs' capital-to-assets ratios and the business and credit cycles. This negative association is stronger for regulated MFIs, particularly bank-MFIs as they must comply with the minimum regulatory capital requirement throughout the cycle. Our investigation into the channels of this cyclical capital adjustment suggests that regulated MFIs are more likely to draw down their capital ratio buffer (excess capital above the regulatory minimum) during booms by expanding their assets much more quickly than their equity level (as risk perception falls). The opposite happens in recession: as risk increases with higher default and capital losses, regulated MFIs are more likely to cut their lending to adjust, as they cannot retain sufficient earnings to meet the minimum regulatory capital requirements. We then predict that less regulated MFIs such as NGO-MFIs and Coop/CU-MFIs might stick to a more conservative capital ratio behavior, as they only have to adjust their economic capital ratio on a discretionary basis. The study shows that NGOs' capital ratios are not affected by the business cycle as these organizations target poor and vulnerable clients whose activities are less procyclical. Our findings remain robust to alternative model specifications and estimation techniques. Finally, our findings have strong policy implications for regulators and policymakers in the microfinance sector in the sense that

the current countercyclical capital buffer proposal of Basel III may be more appropriate for regulated bank-MFIs, and less so for pro-poor oriented MFIs like NGOs. Therefore, in drafting related regulation, regulators and policymakers should bear in mind that "one size fits all" practice is not suitable for all microfinance institutions.

The rest of the paper is organized as follows. Section 2 presents the econometric framework, data and variables. Empirical results and analyses are discussed in section 3. We conduct further robustness checks in section 4. We conclude in section 5.

2. Econometric model, data and variables

2.1. Econometric model

To answer our research question, of whether microfinance capital ratios are procyclical or countercyclical, following empirical banking capital structure studies (e.g., De Jonghe and Öztekin, 2015; Guidara et al., 2013; Jacques and Nigro, 1997; Kanga et al., 2017; Öztekin, 2015; Rime, 2001; Shrieves and Dahl, 1992; among many others), we model MFIs' capital ratios using the partial adjustment framework. Although these earlier studies have been applied to banks, we rely on the partial adjustment framework by assuming that MFIs target an optimal capital-to-assets ratio toward which they adjust partially each period. A similar framework has been used by Hessou and Lai (2017 and 2018) for Canadian credit unions. The partial adjustment model is justified here by the fact that capital building is time and resource consuming, and that MFIs cannot entirely adjust their capital during a single period. Unlike banks, which are more homogenous financial institutions, MFIs are more diverse and include different types of ownership structure and regulation status. Regulated MFIs (mostly bank-MFIs) might target a capital ratio to comply with the minimum regulatory capital adequacy requirement.[2] This is because capital accumulation is sluggish, as it requires MFIs to retain their profit or

[2] One may wonder whether MFIs status (Bank versus non-Bank MFI) is related to their regulatory status. As shown by our data, 66% regulated MFI are microfinance banks, while 72% of NGOs (non-bank) are not regulated. To investigate how MFI regulation status and ownership type are related, we perform a Pearson Chi-Squared test, which confirms the dependence between the two variables at 1%. Based on this correlation result, latter we run our regressions separately by regulation status and ownership type.

benefits from donations or raise new equity capital. In addition, the optimal capital ratio might depend on the riskiness of MFIs' assets and their ability to meet capital shortfall in a timely manner. Beside the regulatory concerns, both regulated and unregulated MFIs might adjust toward an optimal economic capital target to cushion potential asset losses that might be higher than provision expenses. Therefore, the use of the partial adjustment framework is justified for the capital adjustment of unregulated MFIs as well. The adjustment behavior of MFIs' capital is as follows:

$$\Delta \mathrm{CAR}_{\mathrm{ij,t}} = \lambda(\mathrm{CAR}^{*}_{\mathrm{ij,t}} - \mathrm{CAR}_{\mathrm{ij,t-1}}) + \eta_{\mathrm{ij,t}}, \qquad (1)$$

where in each year *t* and in country *j*, MFIs (indexed by *i*) adjust a proportion λ of the difference between their *desired* (or long term) capital ratio $CAR^{*}_{ij,t}$ and their actual capital ratio $CAR_{ij,t-1}$. $\Delta CAR_{ij,t}$ is computed as the difference between the current capital-to-assets ratio ($CAR_{ij,t}$) and the previous year's capital ratio ($CAR_{ij,t-1}$). $\eta_{ij,t}$ is the idiosyncratic error. We assume that the long-term target $CAR^{*}_{ij,t}$ is a function of MFIs' characteristics and macroeconomic conditions as follows:

$$\mathrm{CAR}^{*}_{\mathrm{ij,t}} = \alpha_0 + X_{\mathrm{ij,t-1}}\beta^{*} + W_{\mathrm{jt}}\gamma^{*}, \qquad (2)$$

with $X_{ij,t-1}$ a vector of MFI-level characteristics (size, risk, performance, loan officer, depth of outreach) and W_{jt} the macroeconomic indicators of country *j* in year *t* (and includes the GDP growth and the credit-to-GDP growth). After entering (2) in (1), we get the following equation:

$$\begin{aligned}\Delta \mathrm{CAR}_{\mathrm{ij,t}} &= \lambda(\alpha_0 + X_{\mathrm{ij,t-1}}\beta^{*} + W_{\mathrm{jt}}\gamma^{*} - \mathrm{CAR}_{\mathrm{ij,t-1}}) + \eta_{\mathrm{ij,t}} \\ &= -\lambda \mathrm{CAR}_{\mathrm{ij,t-1}} + \lambda\alpha_0 + X_{\mathrm{ij,t-1}}\lambda\beta^{*} + W_{\mathrm{jt}}\lambda\gamma^{*} + \eta_{\mathrm{ij,t}}. \qquad (3)\end{aligned}$$

Consistent with the literature, equation (3) assumes persistence of the capital ratio if λ is statistically significant. This is plausible given that capital adjustment over a given period will be more, or less, likely depending on the existing capital ratio. This persistence also justifies the use of our current framework.

To estimate equation (3), we apply the generalized method of moments (GMM) estimator developed for dynamic panel data by Arellano and Bond (1991) and extended by Arellano and Bover (1995) and Blundell and Bond (1998). This estimation method is more suitable for the structure of our dataset described below, which has large N (1414 MFIs) and small T (14-year period, from 2001 to 2014).[3] This technique is designed to address several econometric issues in panel data analysis such as persistence, endogeneity and omitted variables.

To control for the possible endogeneity of the capital-to-assets ratio (CAR) and the MFI-level variables, we use the GMM-style instruments composed of the lags between the 2nd and the 10th of the CAR variable and instrumental variables (IV) style instruments composed of the first lags of exogenous variables as instruments. All instruments are collapsed and their performance tested using the Hansen test, as the Sargan test is less efficient under the two-step GMM.[4]

2.2. Data

To analyze issues specific to the microfinance sector on both the supply and demand sides, empirical studies in microfinance tend to focus on one of the three main sources of data. The first source concerns hand-collected data (i.e. data collected by the researchers themselves). The second source is third-party data such as rating reports produced by agencies that specialize in rating microfinance institutions.[5] The third source is self-reported data, such as the MIX database. Even though the first two data sources are considered by some studies (e.g., Hudon and Traca, 2011; Galema et al., 2012) to be more

[3] Many MFIs have limited data and so our panel is unbalanced. 25% of MFIs have only a single year of data and are therefore automatically deleted from the regressions because we use lags. The average number of data points per MFI is 3 and the maximum is 9. So, use of system-GMM is justified. More than 70% of the database consists of MFIs with less than 5 data points.

[4] In addition, following the existing literature (see Lemmon et al, 2008, JF, page 1599, and Table VI), we implement pooled OLS and fixed effects estimations to provide a band for the coefficient of lag estimated with the system-GMM. The pooled OLS estimate is upward-biased because of the correlation between the lag and the errors. However, with the within estimator, the coefficient is downward-biased because the lag is now correlated with (minus) the lag of the error (see Baum, 2013, page 24 for details). The unreported results, available from the authors upon request, support our key findings.

[5] Namely, Planet Rating, Crisil, Microfinanza Rating, Microrate, and M-Cril.

reliable and more representative of the microfinance industry than self-reported data such as the MIX database, use of the MIX database is nevertheless growing in the microfinance empirical literature (Bogan, 2012; D'Espallier et al., 2013; Servin et al., 2012; Tchakoute Tchuigoua, 2014; 2016; Vanroose and D'Espallier, 2013).

Our objective is to study the cyclical capital adjustment behavior of MFIs with respect to business and credit cycles. This requires having MFI-level data over a relatively long time period. The advantage of the MIX database is that it enables us to collect longitudinal data covering 2001 to 2014. It therefore seems more appropriate as a data source for our study. The MIX is an online microfinance platform that ensures financial transparency of MFIs, and thus helps to address key challenges faced by MFIs, namely, the lack of reliable, comparable and publicly available information. It provides data on market conditions, individual MFI's performance and the financial inclusion landscape. As of September 2017, the date on which we gathered the data, the MIX platform discloses information on about 2,000 key microfinance institutions around the world. As argued by Bogan (2012), being a worldwide database, the MIX database is representative of the sector as it accounts for several MFI characteristics and covers a large part of the sector. Moreover, MFIs reporting to the MIX database serve a large number of microfinance clients.

However, using the MIX database raises at least two issues related to the existence of a sample selection bias, and the reliability of data. To the extent that only MFIs wishing to disclose information voluntarily decide to disclose their financial statements to the MIX, working with the MIX data induces a sample selection bias that we have neglected in this study. Moreover, the data disclosed by the MIX are of unequal quality. Indeed, the MIX uses a five-point ordinal scale (diamond scale) to classify MFIs according to their level of transparency and reliability of information. The highest diamond levels (four and five) indicate that the organization has supplied audited financial statements and/or is rated by rating agencies specialized in rating MFIs. To overcome the criticism on data reliability, we focus on MFIs with at least a four- or five-diamond disclosure rating on the MIX. The financial statements of these MFIs are certified by the auditors, and for some of them, by

the Big 4 accounting firms. Besides the fact that their financial statements are audited by audit firms, those at level 5 are rated by rating agencies.

Focusing on MFIs with reliable data as evaluated by MIX enables us to build an unbalanced panel of 6148 MFI-year observations across a total of 1475 MFIs over 2001-2014. Furthermore, the database is adjusted to limit the influence of outliers. Specifically, all MFI-year observations involving a greater than 100% or a negative (<0%) capital-to-assets ratio (CAR) are excluded as these MFIs are either insolvent or operating under an odd capital structure. This process removes 92 MFI-year observations from our database. Our final sample consists of 1414 MFIs over a 14-year period (from 2001 to 2014) for a total of 5996 MFI-year observations. The final sample includes MFIs from six main regions of the world defined by the MIX (Table 1.C): Africa (286 MFIs), East Asia and the Pacific (170 MFIs), Eastern Europe and Central Asia (216 MFIs), Latin America and Caribbean (428 MFIs), Middle East and North Africa (55 MFIs) and South Asia (259 MFIs). Appendix 1 provides the number of observations in the sample by country.

Table 1.A below gives a summary of the sample distribution by year. The data are unevenly distributed across the years, and hence the panel sample is unbalanced. We have three important types of MFIs in our sample as shown in Table 1.B: a) privately owned MFIs, which includes microfinance banks and NBFIs (non-bank financial institutions) (51.67%), b) cooperatives and credit unions (Coop/CU-MFIs) (12.35%) and c) NGOs or pro-poor MFIs (35.98%). 67.7% of MFIs in the sample are regulated, while the remaining 32.3% are non-regulated.

(Insert Table 1.A, 1.B and 1.C here)

Country-level data comes from the World Bank's Global Financial Development (GFD)[6] and World Development Indicators (WDI) databases, while data on the credit-to-GDP gap comes from the website of the Bank for International Settlements (BIS).

2.3. Variables

[6] Website: https://data.worldbank.org/data-catalog/global-financial-development

2.3.1. The dependent variable

The MFIs' capitalization is measured by the capital-to-assets ratio, the so-called capital adequacy ratio (CAR). Capital is measured as the sum of Tier 1 capital and Tier 2 capital. Unfortunately, the MIX database does not allow us to distinguish between Tier 1 capital and Tier 2 capital; we will therefore restrict ourselves to the aggregate capital ratio.

2.3.2. The main explanatory variables: Business and credit cycles

Changes in a capital-to-assets ratio (ΔCAR) are countercyclical if they are positively related to the performance of the economy. Indeed, financial sector regulators are now considering macroprudential regulation of capital ratios to cool down the economy when it is in an upswing and stimulate the economy when it is in a downturn. To achieve that, regulators expect deposit financial institutions to manage their capital in a countercyclical manner. Financial institutions will be required to increase their capital buffers during periods of booms when capital costs less and profits above average, which can be used to sustain their lending activities during hard economic times.

Our data covers the 2001-2014 period and therefore covers at least one business cycle: the pre-crisis period (2001-2007), the financial crisis period (2007-2009) and the post-crisis period (2009-2014). There is still debate in the literature about the right anchor for macroprudential regulation of capital, as some authors suggest the economic growth indicator, the real GDP growth (GDPG). We complement this business cycle variable with the credit cycle indicator because financial crises are frequently preceded by episodes of rapid credit growth. Indeed, several recent studies in the economics literature have pointed out that abnormal credit growth can be taken as an indication of increased risk-taking behavior by the financial sector and can therefore be used as a leading indicator of financial crises (e.g., Borio and Drehmann, 2009; Drehmann et al., 2011; Jorda et al., 2011; Schularick and Taylor, 2012; Gourinchas and Obstfeld, 2012). According to Boar et al. (2017), the main leading economic measure to achieve the macroprudential regulation

would be the credit-to-GDP gap. Credit-to-GDP growth (CGDPG) is used to capture the credit cycle.

2.3.3. The MFI-specific variables and MFI characteristics

We account for the specificities and distinctive features of MFIs that are likely to affect capital adequacy ratios, or to mitigate or exacerbate the effect(s) of business and credit cycles on MFIs' capital. Some of them are related, directly or indirectly, to lending and are likely to affect loan repayment performance and thus limit credit default risk. We put specific emphasize on MFIs' credit approval and monitoring process. We also account for the double bottom line and control for MFIs' depth of outreach, profitability, and the riskiness of MFIs' loan portfolios.

The credit approval and monitoring variables

To capture the credit approval and monitoring effect, we use two proxies.[7] The first is the Loan officer effectiveness (LO), measured as the number of borrowers per loan officer. It captures the intensity of labor in loan portfolio management, especially monitoring of borrowers. Indeed, microlending tends to be a highly decentralized process and is based on the use of soft lending technologies. In addition, credit approval by loan committees depends heavily on the skill and integrity of loan officers and managers for accurate and timely information. Consequently, the quality of the MFI loan portfolio heavily depends on the ability of the loan officer to monitor borrowers' behavior effectively. The higher this variable the less efficient the loan officer will be, and given the resulting greater riskiness of the loan portfolio MFIs will maintain a positive level of equity as a cushion against loan portfolio deterioration. Although in many MFIs the loan officer can be appointed to tasks not necessarily directly related to monitoring borrowers, nevertheless, their main objective remains the performance of the loan portfolio,

[7] Over more than half of the period covering our study (from 2001 to 2008), data on the distribution of outstanding loans by business category, location (urban or rural) and the type of loans used are not available.

therefore monitoring borrowers is still part of their tasks.

The second is the SIZE of the MFI which we use as a proxy of relationship lending. Indeed, to date relationship lending-based literature shows that small size appears to be a feature of financial services providers that extensively use soft information and are more involved in relationship lending. Following Schaeck and Cihàk (2012) and Tchakoute Tchuigoua (2016), we expect a negative relationship between the size and the capital ratio. We measure SIZE as the log of the number of active borrowers.

The double bottom line variables

Targeting the poor (DEPTH). We also investigate whether targeting low income people and disabled borrowers is likely to affect the equity ratio. MFI clients are often assumed to be less sensitive and less exposed to shocks and macroeconomic disruptions because they operate primarily in the informal sector. Nowadays, the structure of MFIs' clientele has changed. In particular, it has become diversified due to the commercialization of the microfinance industry, and the so-called microfinance mission drift. Many MFIs now target wealthy clients with higher ability to repay, and provide loans to small and medium size enterprises (SMEs) and some microenterprises operating in the formal sector. The depth of outreach (DEPTH) captures the financial condition of MFIs' clientele and is measured as the average loan size per borrower scaled by the per capita gross national income (GNI). A value greater than 1 means that MFIs target wealthier clients with higher ability to repay. We expect MFIs with higher depth of outreach to have better repayment performance and hence lower capital-to-asset ratios. However, wealthy clients and SMEs are more sensitive to macroeconomic shocks, which means that during economic downturns, their expected credit risk increases, and MFIs restrict their lending activity. The capital adequacy ratio thus increases and serves as a cushion to absorb unexpected loan losses. We thus expect MFIs which target wealthy clients to have procyclical capital adequacy ratios.

Riskiness of the loan portfolio. As indicated by the successive surveys of the Centre for the Study of Financial Innovation (CSFI), which describe the risks facing the global

microfinance industry, the fierce competition between MFIs in the microcredit market is one of the distinguishing features of the sector. Competition is likely to lead to imprudent lending, over borrowing and multiple contracting which in turn can lower loan repayment performance (McIntosh and Wydick, 2005; McIntosh et al., 2005). As documented by the existing banking and microfinance literature (Allen et al., 2011; Boyd and De Nicolo, 2005; Martinez-Miera and Repullo, 2010; Schaeck and Cihàk, 2012; Tchakoute Tchuigoua, 2016), moral hazard problems resulting from competition in credit markets give incentives to banks to hold positive levels of capital. Competition affects loan portfolio quality which in turn provides incentives to hold positive equity levels as a cushion against loan portfolio deterioration and default risk. The riskiness of the loan portfolio is measured by the MFI's portfolio at risk at 30 days (PAR30), computed as the 30 days non-performing loans as a share of total loans. The PAR30 captures the part of the portfolio affected by outstanding payments when there is a risk that they will not be repaid. We expect a positive relationship between risk and the capital ratio of the MFI.

Profitability. Previous research in both the banking and microfinance sectors (Berger et al., 2008; Gropp and Heider, 2010; Schaeck and Cihàk, 2012; Tchakoute Tchuigoua, 2016) provides empirical evidence that an institution's profitability is positively related to the equity ratio. We thus account for the fact that MFIs are likely to retain some of their earnings to increase their capital. The level of equity will therefore increase as the MFI generates more profits. Thus, the higher the profitability, the higher the equity ratio. We measure profitability as the return on assets (ROA) and consider it as a control variable.

Table 2 summarizes all the variables used in this study, with their description and data source.

(Insert Table 2 here)

3. Empirical results

3.1. Univariate analysis

In this section we present the descriptive analysis of the variables used in the study. Figure 1 plots the evolution of average changes in CAR and economic growth over the study period. On average, MFIs have experienced a leveraging of their business through the entire study period and most especially up to 2007. From the panels of Figure 1, it can be observed that the average change in capital-to-assets ratios is negative throughout the period reflecting the leveraging of the sector since 2000. MFIs' average capital-to-assets ratio drops from a high of 40% in 2001 to 22% in 2009, and stays at about that level for the remainder of the period.

(Insert Figure 1 here)

Table 3.A summarizes the descriptive statistics of the whole sample. We further the analysis by splitting the sample by MFI ownership type (Table 3.B) and regulation status (Table 3.C). Although the capital-to-assets ratio of non-regulated versus regulated MFIs are significantly different (40.4% for non-regulated MFIs and 29.1% for regulated MFIs), we find almost no difference in annual CAR changes when comparing MFIs which are regulated (-1.7%) and those that are not (-1.4%) (Table 3.C). There are, however, important differences in changes in CAR among bank-MFIs (-2.1%), Coop/CU-MFIs (-0.5%) and NGOs (-1.2%). Also, their CAR levels are different: 30.4% for bank-MFIs, 24.5% for Coop/CU-MFIs and 38.7% for NGO-MFIs (Table 3.B). Overall, the capital-to-assets ratio averages 32.8% with a median value of 24.9%, suggesting that the distribution is positively skewed (Table 3.A). This is confirmed by the distribution of the capital-to-assets ratio plotted for the entire period and for years 2001, 2007 and 2014 in Figure 2.

(Insert Table 3.A, 3.B, and 3.C here)

(Insert Figure 2 here)

We measure the size of the MFIs using the log of the number of active borrowers. We present the statistics on the actual numbers of active borrowers and the log value in parenthesis. The average number of active borrowers per MFI in our database is 90,567 borrowers (9.45). This number is, however, driven by large MFIs considering that at least

half of the MFIs have less than 12,200 borrowers (9.41). We split our sample by MFI ownership and regulatory status. We find that regulated MFIs (dominated by bank-MFIs) are larger with 99,866 active borrowers (9.63) than non-regulated MFIs with 71,259 active borrowers (9.07). Concerning MFI ownership type, bank-MFIs are the largest with 110,175 active borrowers (9.75), followed by NGOs with an average of 90,212 active borrowers (9.39) and Coop/CU with an average of 17,476 active borrowers (8.41).

On average, portfolio-at-risk at 30 days represents 5.05% of MFIs' gross loan portfolio. Regulated MFIs on average have a relatively lower quality loan portfolio than non-regulated MFIs, with a PAR30 of 5.20% versus 5.00%. Concerning MFI type, we find that Coop/CU-MFIs have higher portfolio risk (6%), followed by bank-MFIs (5.1%) and NGO-MFIs (4.8%). NGOs are less risky but hold higher capital ratios.

The average profitability is 2.02% of total assets. We find no significant differences in ROA by MFI type. There is, however, a difference in profitability between regulated and non-regulated MFIs, with regulated MFIs being more profitable (2.2%) than non-regulated ones (1.7%).

We find an average of 0.762 for the depth of outreach (DEPTH) variable. The higher the value of this indicator, the higher the proportion of wealthy borrowers served by the MFI. We find an important difference between regulated and non-regulated MFIs. The indicator averages 0.343 for non-regulated MFIs and 0.963 for regulated MFIs. This suggests that regulated MFIs are more likely to serve wealthier borrowers. Concerning MFI type, we find that banks are more interested in wealthier borrowers with a depth of outreach of 1.035. The index averages 0.854 for Coop/CU-MFIs and 0.326 for NGOs. This suggests that NGO-MFIs are the most oriented toward poor borrowers, followed by Coop/CU-MFIs.

For the number of active borrowers per loan officer, on average, each loan officer monitors 253 borrowers (log is 5.53). In logarithm, this number is 5.518 for regulated MFIs and 5.55 for non-regulated ones. Concerning MFI ownership type, Coop/CU-MFIs have

the highest load per loan officer (5.72) followed by NGOs and bank-MFIs (5.59 and 5.46 respectively).

3.2. Bivariate analysis

Our bivariate analysis mainly focuses on the relation between changes in capital-to-assets ratios (ΔCAR) and MFI-level variables or macro variables based on the correlation matrix summarized in Table 4. The correlation between changes in capital-to-assets ratios (ΔCAR) and the level of capitalization in the previous year is strongly negative (-41.2%), confirming our assumption about the partial adjustment in MFIs' capital. Large MFIs (measured by SIZE) have more and more highly positive variations in their capital-to-assets ratios than the smallest ones. In addition, the correlation analysis suggests that MFIs with more borrowers per loan officer (LO) generate positive CAR variation. More importantly, business cycle and credit cycle variables (GDPG and CGDPG) are positively correlated, but are negatively related to the annual change in the MFIs' capitalization (ΔCAR). The panels of Figure 1 above show the co-movement between the average change in the capital-to-assets ratio (ΔCAR) and the real GDP growth (GDPG), for the whole sample and by MFI type, respectively. The graphs seem to indicate opposite movement between the two variables across the whole sample and for bank-MFIs and Coop/CU-MFIs. But, for NGO-MFIs, the co-movement seems to be positive. We are not concerned with potential multicollinearity as the correlations amongst all the variables are below 40%.

(Insert Table 4 here)

3.3. Multivariate analysis

3.3.1. Baseline results

We answer our first research question by testing our main hypothesis that $\gamma^* < 0$ in equation (3), meaning that MFIs do not anticipate future recession and so build their capital-to-assets ratio in a procyclical manner. To achieve our goal, we rewrite equation (3) as follows:

$$\mathrm{CAR}_{\mathrm{ij,t}} = \mathrm{CAR}_{\mathrm{ij,t-1}} + \lambda(\alpha_0 + X_{\mathrm{ij,t-1}}\beta^* + W_{\mathrm{jt}}\gamma^* - \mathrm{CAR}_{\mathrm{ij,t-1}}) + \eta_{\mathrm{ij,t}}$$

$$= (1-\lambda)\mathrm{CAR}_{\mathrm{ij,t-1}} + \lambda\alpha_0 + X_{\mathrm{ij,t-1}}\lambda\beta^* + W_{\mathrm{jt}}\lambda\gamma^* + \eta_{\mathrm{ij,t}}. \quad (4)$$

The new equation (4) relies directly on the CAR as a dependent variable and does not require differentiation of the variable. This transformation does not affect our results and is mainly motivated by the fact that the differentiation will further reduce our available data points. Table 5 presents the regression results of the dynamic adjustment of CARs by MFIs.

(Insert Table 5 here)

Our main results obtained with the system-GMM method suggest that MFIs do have an optimal target capital ratio and adjust toward it on an annual basis. MFIs, annually, adjust roughly 10% (λ=1-0.9) of their capital-to-assets shortfall. The existence of the optimal target is confirmed by the fact that some variables (especially the business cycle and the credit cycle variables) included in the target equation (2) are statistically significant, suggesting that they drive MFIs' optimal target. We find that the macroeconomic environment (business and credit cycles) has an important impact on the capital target and therefore on annual variation in capital-to-assets ratios. Our analysis suggests that changes in MFIs' capital-to-assets ratios are negatively related to the business cycle and the credit cycle with sensitivity coefficients, respectively, of -0.175 and -0.051, both significant at 1%.

For robustness check, we re-run the estimation in equation (4) using fixed effects and random effects estimation techniques. We obtain more or less similar signs and significance levels. However, with these two alternative estimation techniques, λ lies between 0.23 and 0.44, as contrasted with 0.10 obtained with the dynamic panel estimation method.

3.3.2. Results by MFI ownership type and regulation status

In this part of our analysis, for our second research question, we assess whether the

procyclical behavior of MFIs' capital adjustment is homogeneous by MFI ownership type and regulation status. Doing this second-layer analysis is justified by the following. First, MFIs provide financial services to unbanked people under various institutional forms: banks and non-bank financial institutions (NBFIs), also known as privately owned MFIs; cooperatives and credit unions; and microfinance NGOs. In the microfinance landscape, access to commercial sources of external finance (domestic or international) is a distinctive feature of privately owned MFIs. They have access to local and international investors with debt financing through commercial loans and bonds, as well as equity financing in the form of privately or publicly held shares (D'Espallier et al., 2017). Access to external and commercial funding is one of the main reasons why, in recent years, a number of NGOs have transformed institutional form by adopting the status of private microfinance company. Privately owned MFIs are more linked to financial markets and, as such, may be more vulnerable to financial and economic turmoil than NGOs. Indeed, during economic downturn, raising external capital may be costly and difficult and the inability of MFIs to raise funds due to scarcity of funds and investor fears can restrict their lending activity. In addition, given that microfinance banks adopt management practices similar to those of conventional banks, they may be expected to implement similarly sophisticated risk management practices, as opposed to those used by cooperatives and NGOs. Therefore, during economic slowdown, one may expect privately owned MFIs to behave like banks, that is, to shrink lending if their loan portfolio credit risk turns out to be too high, leading to procyclical adjustment of their capital ratio. Based on these differences in the behavior of MFIs by type, we separately investigate capital adjustment of for-profit MFIs versus not-for-profit MFIs such as NGOs. In particular, capital holding and adjustment by some institutions such as NGOs might be artificially high due to donations. This explains why we conduct separate analysis by MFI type.

Additionally, we account for the MFIs' regulation status because some MFIs are subject to prudential regulation, while others are not. We expect regulated MFIs to hold a positive equity ratio in order to avoid costs associated with supervisory actions, i.e. the cost of having a capital ratio below requirements.

We thus split the sample by the main forms of ownership type in microfinance, being privately owned MFIs (banks and NBFIs), cooperative and credit unions, and NGOs, and also by whether MFIs are subject to prudential regulation or not, and then re-estimate equation (4).

The behavior of the change in capital-to-assets ratios is likely to differ by MFI type as shown in Figure 1 above. The multivariate analysis results provided in Table 6 suggest that the negative relationship documented previously for the business cycle is mostly driven by the regulated MFIs in the sample, which are mostly bank-MFIs. This finding suggests that bank-MFIs are the most at risk to adjust their capital ratio in a procyclical manner, i.e. negatively relative to the business cycle, meaning that they accumulate less capital in booms to be used during recessions when capital is scarce and costly. In other words, when a negative economic shock materializes, MFIs catch up with their capital shortfall by limiting loan growth to avoid being in default. This procyclical behavior might be justified by the regulatory constraint; most bank-MFIs are subjected to regulatory capital adequacy requirement, which is not the case for other MFI types. This practice diverges from the best practice endorsed by the current Basel III recommendation for banking sector capital adjustment behavior.

(Insert Table 6 here)

Table 7 confirms the above results when we replace the business cycle variable by the credit cycle variable (CGDPG) for our regressions by MFI ownership type (bank/NBFI, CU/Coop and NGO) and regulation status (regulated and non-regulated). Indeed, results with the CGDPG support the significant negative co-movement of bank-MFIs and regulated MFIs with respect to CAR variation and the credit cycle. For NGOs and non-regulated MFIs, however, the results are inconclusive. The coefficient is not significant, which confirms our a priori expectation that NGOs, which are pro-poor MFIs, are less affected by the business cycle as their clientele are mainly in the informal economy sector and are sheltered from business cycle variations.

(Insert Table 7 here)

In sum, our findings suggest that banks and regulated MFIs lower their "capital defense" in periods of boom or excessive credit build-up, in sharp contradiction with the current trend towards a capital countercyclical buffer endorsed by the Basel III regulation. This study's findings are therefore of important relevance in the implementation of a safer financial system around the globe, especially for the microfinance sector which to date has been left behind in the current macro-prudential regulatory debate.

3.3.3. Asset-side versus liability-side transmission channel

In this section, we deepen our understanding of the procyclical effect documented in previous sections by addressing our third research question. We aim to analyze the balance sheet channel through which the capital ratio adjustment occurs: asset-side versus liability-side. More precisely, we decompose the capital ratio by considering its two components (numerator (capital) and denominator (asset)) separately and study how each varies with the business cycle. For comparability among MFIs, we compute the change in the numerator as the capital growth, and the change in the denominator as the asset growth.

In Figure 3, we plot the joint dynamic between the real GDP growth (our measure of the business cycle) and both the capital growth and the asset growth. We find evidence of a positive relationship between both the capital and asset growth with the business cycle indicator. This is evidence that both the equity capital and asset of MFIs decrease (increase) during downturns (expansions). The question pertains to the intensity of the marginal change on each side of the balance sheet, i.e. which one of asset or equity capital variations contributes more to the observed capital ratio change during a given business cycle.

(Insert Figure 3 here)

Our finding about the negative relationship between MFIs' capital ratios and the business cycle indicator could be explained by the fact that, during downturns, the drop

in MFIs' assets outweighs the decrease in equity capital. We further explore this via the following regression equation:

$$\mathrm{Y_{ij,t}} = \lambda \mathrm{Y_{ij,t-1}} + \beta X_{\mathrm{ij,t-1}} + \gamma^{*} GDPG_{\mathrm{jt}} + \eta_{\mathrm{ij,t}}, \quad (5)$$

where $Y_{ij,t}$ is either MFI *i*'s asset growth (ASSG) or equity capital growth (EQG), from country *j* at year *t*. As previously defined and summarized in Table 2, $X_{\mathrm{ij,t-1}}$ is the MFI's specific characteristics. It includes the size of the MFI (SIZE), measured as the natural logarithm of the number of total active borrowers, the portfolio at risk at 30 days (PAR30), the return on assets (ROA), the logarithm of the number of borrowers per loan officer (LO) and the depth of outreach (DEPTH). Our coefficient of interest γ^{*} measures the cyclical variations of $Y_{ij,t}$.

We estimate equation (5) for each of the dependent variables (asset growth or equity growth) by means of fixed effects and random effects panel estimation methods. We allow for potential autocorrelation and heteroskedasticity in errors. The results presented in Table 8 (for asset growth) and Table 9 (for equity growth) confirm the positive co-movement between asset growth, and equity growth and the business cycle, highlighted in Figure 3. In the following we provide the interpretation for the fixed effects estimates, as the random effects yield similar intrepretation. Moreover, we find that MFIs' assets react more to business cycle variations than do their equity capital, with respective marginal growth rates of 1.180 and 0.426 (in the fixed effects estimations) associated with a one-unit variation in real GDP growth. In other words, the marginal positive (negative) variation in assets outweighs the marginal increase (decrease) in equity capital, hence implying an overall negative impact of the business cycle on the capital ratio.

The above behavior of MFIs asset growth with the business cycle is consistent with Wagner and Winkler (2013). These latter authors evidenced a drop in loan growth during financial crises; and since MFI assets are mainly composed of loans, any variation in their credit portfolio will more or less affect similarly their total asset. It is however important

to stress the fact that our objective of studying the asset growth behavior was more to investigate the asset-side channel of the cyclical variation of MFI capital.

(Insert Table 8 & Table 9 here)

With respect to the regulation status of MFIs, we find that the assets of regulated MFIs are more sensitive to business cycle variations. The effect of the business cycle on regulated MFIs' assets is roughly one-and-a-half to twice that of unregulated MFIs. As for the ownership type, the same finding regarding regulated MFIs holds for bank-MFIs which comprised most of the regulated MFIs. While not-for-profit MFIs (NGOs and Coop/CU) appear to be insensitive to the business cycle as shown in Table 6 above, examiming the channels (Table 8 and Table 9) reveal that NGOs adjust both assets and capital with the business cycle to maintain their CAR, whereas Coop/CU appear to be completely insensitive to the business cycle on both assets and capital. Indeed, NGOs rely on donators to fund their assets and, as a consequence, are more likely to face financing shortage from these fund providers during stress times; accordingly, they should adjust their asset level.

The above results are in line with our previous finding that regulated or bank-MFIs exhibit more procyclical capital behavior. In addition, the fact that the sensitivity cofficient in the equity growth equation is significant for regulated MFIs could be attributed to regulatory pressure from regulators.

For further analysis, we perform the estimations using quantile regressions to investigate whether our results are driven by MFIs in the tail of the distribution (large and/or small MFIs). The results obtained and reported in Table 10 overall support our previous findings.

(Insert Table 10 here)

In sum, our findings show that MFIs' capital ratios and the business cycle co-move negatively, and MFIs adjust their capital ratio in downturns by shrinking their assets, while during expansions, they adopt a strategy of leveraging their balance sheet, which decreases their capital ratio. Such procyclical dynamic capital adjustment behaviors are

observed for the case of regulated MFIs and bank-MFIs, whereas non-regulated and NGO-MFIs do not seem to be affected by the business cycle variations.

4. Robustness check

As robustness checks, below we provide alternative analysis and control to test the resilience of our findings to different model specification and estimation techniques.

4.1. Controlling for the crisis effect

First, we investigate whether the financial crisis of 2006-2009 had any specific effect on our findings. We then split our sample to capture the financial crisis effect. More specifically, we split our sample into three periods: the pre-crisis, the crisis and the post-crisis. This allows us to gauge whether the proyclical behavior documented above existed before the crisis, how it evolves during the crisis period and if it survives the possible corrective actions in the post-crisis period.

The results presented in Table 11 suggest that the procyclical capital adjustment behavior exists both during the pre-crisis period and the crisis period, with the effect being stronger during the crisis period. Interestingly, the effect quietly vanishes in the post-crisis period.

(Insert Table 11 here)

4.2. Estimating a static model

In addition to the analysis by sub-period, we investigate the robustness of our findings to the model specification by specifying a static model and by using fixed effects and random effects estimation techniques, instead of the dynamic method, to perform the estimation. The static model specification helps us respond to skepticism on the question of whether the partial adjustment framework effectively reflects actual decisions or outcomes in the microfinance sector. Indeed, some may question the use of partial adjustment framework, as many MFIs, especially NGOs and Coop/CUs, unlike banks, are not bound by a minimum capital adequacy requirement, and thus do not need

to adjust their capital as the partial adjustment theory would suggest. In addition, even though some MFIs and in particular deposit-taking ones would be subject to prudential regulation, in some cases the regulation would not be enforceable. This may be partly due to the fact that regulatory oversight do not seem to work well and its implementation may be costly for the supervisory authority (Christen et al., 2012). We thus hypothesized that, if regulation is not or is less enforceable, i.e. if MFIs do not face regular reporting requirements to the regulatory authority and onsite supervision at regular intervals, then the regulatory authority will not have the assurance that MFIs comply with regulatory requirements, and MFIs will have no incentive to adjust their capital.

Our results with these alternative static estimation methods (fixed effects and random effects) are similar to those documented in the dynamic model estimations both with the economic growth variable (see Table 12) and the credit cycle variable (see Table 13).

(Insert Table 12 & 13 here)

4.3. Quantile regressions

To preclude potential asymmetric effects from our analysis (some MFIs such as NGOs relying on donations are highly capitalised), we implement quantile regression to test whether our findings are driven by MFIs with capital ratios at the tails of the capital ratio distribution. Results for our estimations at percentiles 50 (median), 25 (1^{st} quartile) and 75 (4^{th} quartile) are respectively summarized in tables 14, 15 and 16. Again, these results also support our previous claims.

(Insert Table 14, Table 15 & Table 16 here)

4.4. Additional robustness test

Finally, given the unbalanced nature of our panel data structure, we perform a forward orthogonal deviation transformation (Arellano and Bover, 1995) as additional robustness test. The unreported results support our above findings.[8]

5. Conclusion

This paper tests and finds support for procyclical behavior of MFIs' capital ratios. Interestingly, we document that the procyclical effect is stronger for regulated MFIs as they must adjust their capital ratio throughout the cycle to meet the minimum regulatory capital adequacy ratio requirement imposed by the regulator. As these regulated MFIs are mostly bank-MFIs, our results confirm that the procyclical behavior is more pronounced for bank-MFIs. For NGO-MFIs, the business cycle has no significant effect on their capital ratio. Our findings are robust to numerous checks: control for tail effects via quantile regressions, regression for different time periods (pre-crisis, crisis and post-crisis) and the use of a static model instead of a dynamic one. Our findings support recent evidence that neither banks nor regulated MFIs are immune to macroeconomic risks and that their capital ratio should be regulated in a countercyclical manner as suggested by the Basel III recommendations for banks. This is even so that the capital ratio adjustment in these regulated and bank-MFIs is mainly done by adjusting the asset side of their balance sheet.

As a policy recommendation, in regulating MFIs, policymakers have to keep in mind that one-size-fits-all policy does not work. Indeed, countercyclical buffer requirements similar to Basel III may be imposed on regulated MFIs, while for non-regulated MFIs, which are less involved in mainstream finance and less sophisticated in their risk management practice, imposing this type of requirement may impact their lending behavior with regard to the unbanked people.

[8] The estimation results are available from the authors upon request.

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Table 1: Sample distribution

A. Distribution by year

This table presents the distribution of our sample by year of observation. Statistics are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period.

Year	Obs.	%
2001	121	2.02
2002	199	3.32
2003	294	4.90
2004	401	6.69
2005	483	8.06
2006	536	8.94
2007	539	8.99
2008	633	10.56
2009	549	9.16
2010	598	9.97
2011	606	10.11
2012	475	7.92
2013	327	5.45
2014	235	3.92
Total	5996	100.00

B. Distribution by MFI ownership type and regulation status

This table presents the proportion of MFIs in the dataset by ownership type and by regulation status.

Ownership type			Regulation status	
Banks	Coop/Credit-Unions	NGOs	Regulated	Non-regulated
51.67	12.35	35.98	67.70	32.30

C. Distribution by region

	Observations		Number of MFIs	
Region	Number	%	Number	%
Africa	873	14.56	286	20.23
East Asia and the Pacific	614	10.24	170	12.02
Eastern Europe and Central Asia	973	16.23	216	15.28
Latin America and Caribbean	2208	36.82	428	30.27
Middle East and North Africa	256	4.27	55	3.89
South Asia	1072	17.88	259	18.32
Total	5996	100.00	1414	100.00

Table 2: Variable definitions and descriptions

	Variable	Description
Capital adequacy ratio	Capital-to-assets ratio (CAR)	Capital/Total Assets Capital includes equity plus supplementary capital sources, such as loan loss reserves, asset reserves and subordinated debt. Source: MIX
Credit cycle	CGDPG	Credit-to-GDP Growth Source: BIS
Crisis	Crisis	Dummy: value of 1 if the banking sector faces a crisis, 0 otherwise Source: GFD & WDI
Economic Growth	GDPG	Real Gross Domestic Product (GDP) Growth Source: GFD & WDI
Loan portfolio risk	Portfolio at risk at 30 days (PAR30)	(Outstanding Balance on Arrears over 30 days + Total Gross Outstanding Refinanced (restructured) Portfolio)/Total Gross Portfolio Measurement of portfolio quality. It shows the part of the portfolio affected by outstanding payments when there is a risk that they might not be repaid. The threshold is < 10% given that financial guarantees in microfinance are not always sufficient. Source: MIX
Size of the MFI	SIZE	Log of total number of active borrowers Source: MIX
Profitability	ROA	Return on Assets = Net Operating Income/ Average Assets Source: MIX
Loan Officer - Labor intensity	LO	Log of the number of borrowers per loan officer Source: MIX
Depth of outreach	DEPTH	Average loan size per borrower scaled by the per capita gross national income (GNI) Source: MIX
Regulation	REG	Regulation dummy: value of 1 if the MFI is regulated, 0 otherwise Source: MIX

Note: MIX = Microfinance Information eXchange database. GFD = Global Financial Development database and WDI = World Development Indicators of the World Bank. BIS = Bank for International Settlements.

Table 3: Summary statistics

This table presents the summary statistics of our variables. Statistics are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. Variables used in the study are: the capital adequacy ratio (CAR) measured by the equity-to-assets ratio; the MFI size (SIZE) measured by the natural logarithm of the number of active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring; the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **Macroeconomic variables** include: the real GDP growth (GDPG) and the credit-to-GDP growth (CGDPG). ΔCAR is the first difference of the CAR variable.

A. Whole-sample descriptive statistics

VARIABLES	**N**	**mean**	**p25**	**p50**	**p75**	**min**	**max**
ΔCAR	3703	-0.0165	-0.0437	-0.00650	0.0175	-0.986	1.798
CAR	5996	0.328	0.148	0.249	0.450	0	1
ROA	5496	0.0202	0.00570	0.0241	0.0521	-3.453	0.728
REG	5996	0.677	0	1	1	0	1
CGDPG	3483	0.0559	-0.00541	0.0399	0.0997	-1.152	1.194
GDPG	3507	0.0524	0.0299	0.0509	0.0696	-0.193	0.339
PAR30	5497	0.0505	0.00990	0.0305	0.0602	0	1
DEPTH	5869	0.762	0.139	0.315	0.728	0	112.8
SIZE	5882	9.451	8.251	9.411	10.69	2.303	15.92
LO	4817	5.532	5.179	5.550	5.930	-1.107	11.12

B. Descriptive statistics by MFI ownership type

Ownership type	ΔCAR	CAR	SIZE	PAR30	ROA	LO	DEPTH
Bank	-0.021	0.304	9.759	0.051	0.021	5.456	1.035
Coop/CU	-0.005	0.245	8.413	0.060	0.020	5.721	0.854
NGO	-0.012	0.387	9.396	0.048	0.020	5.589	0.326

C. Descriptive statistics by MFI regulation status

Regulation status	ΔCAR	CAR	SIZE	PAR30	ROA	LO	DEPTH
Regulated	-0.014	0.291	9.633	0.051	0.022	5.518	0.963
Non-regulated	-0.017	0.404	9.073	0.050	0.017	5.558	0.343

D. Descriptive statistics by MFI Region

	CAR	SIZE	PAR30	ROA	LO	DEPTH
Africa	0.370	9.174	0.068	-0.008	5.508	1.210
East Asia and the Pacific	0.295	9.599	0.060	0.030	5.489	0.465
Eastern Europe and Central Asia	0.374	8.535	0.036	0.035	5.071	1.731
Latin America and Caribbean	0.322	9.259	0.052	0.022	5.595	0.524
Middle East and North Africa	0.570	9.714	0.033	0.046	5.438	0.389
South Asia	0.225	10.752	0.047	0.013	5.826	0.276

Table 4: Correlation matrix

This table presents the Pearson correlation matrix of our variables. Statistics are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. The **dependent variable** is the change in capital-to-assets ratio (ΔCAR) measured as the difference between the current capital-to-assets ratio and the previous year's capital-to-assets ratio. **MFI-level variables** include: SIZE, measured by the natural logarithm of the number of active borrowers; the capital adequacy ratio (CAR); the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **Macroeconomics variables** include: the real GDP growth (GDPG) and the credit-to-GDP growth (CGDPG). The prefix "L." in front of a variable designates the lag of the variable. * p<0.05.

	ΔCAR	CAR	L.CAR	L.SIZE	L.PAR30	L.ROA	LO	DEPTH	CGDPG	GDPG
ΔCAR	1									
CAR	0.0620*	1								
L.CAR	-0.4129*	0.8834*	1							
L.SIZE	0.0721*	-0.2711*	-0.2814*	1						
L.PAR30	0.0384*	-0.0076	-0.0245	-0.0713*	1					
L.ROA	0.0182	0.0554*	0.0436*	0.0970*	-0.0379*	1				
LO	0.0716*	-0.1164*	-0.1162*	0.3640*	-0.0436*	0.0901*	1			
DEPTH	-0.0067	-0.0615*	-0.0750*	-0.1501*	-0.0036	-0.0115	-0.3429*	1		
CGDPG	-0.1057*	0.0268	0.0735*	-0.0770*	-0.0731*	0.0338	-0.1224*	0.0640*	1	
GDPG	-0.0843*	-0.0027	0.0368*	0.0482*	-0.0318	0.0151	-0.0228	0.0462*	0.1313*	1

Table 5: Baseline results

This table presents the system-GMM, the fixed effects and the random effects estimates of the capital-to-assets ratio of MFIs. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable** is the capital-to-assets ratio (CAR). **MFI-level variables** include: SIZE, measured by the natural logarithm of the total active borrowers; the capital adequacy ratio (CAR) measured by the equity-to-assets ratio; the portfolio at risk at 30 days (PAR30) measured by the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the logarithm of the number of borrowers per loan officer (LO) captures the quality of monitoring; and DEPTH which measures the fact that the MFI targets the poorest clients. **Macroeconomics variables** include: the credit-to-GDP growth (CGDPG) and the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Business cycle (GDPG)			**Credit cycle (CGDPG)**		
VARIABLES	Syst-GMM	Fixed effect	Random effect	Syst-GMM	Fixed effect	Random effect
L.CAR	**0.900*** **	**0.559*** **	**0.765*** **	**0.908*** **	**0.557*** **	**0.763*** **
	(0.0312)	(0.0376)	(0.0186)	(0.0319)	(0.0374)	(0.0186)
L.SIZE	0.00149	**-0.0132***	**-0.00397** **	0.00152	**-0.0131***	**-0.00410** **
	(0.00143)	(0.00677)	(0.00170)	(0.00139)	(0.00684)	(0.00167)
L.PAR30	**0.0537***	0.0576	0.0368	**0.0514***	0.0585	0.0383
	(0.0289)	(0.0464)	(0.0285)	(0.0294)	(0.0466)	(0.0285)
L.ROA	-0.0182	3.83e-05	0.0247	-0.0242	0.0266	0.0242
	(0.0371)	(0.0607)	(0.0389)	(0.0469)	(0.0617)	(0.0390)
LO	0.00469	-0.00529	-0.00104	0.00228	-0.00445	0.000184
	(0.00871)	(0.00497)	(0.00342)	(0.00858)	(0.00654)	(0.00379)
DEPTH	-0.00318	**-0.0108** **	**-0.00827*** **	-0.00309	**-0.0104** **	**-0.00757*** **
	(0.00358)	(0.00502)	(0.00241)	(0.00337)	(0.00513)	(0.00239)
GDPG	**-0.175*** **	**-0.135*** **	**-0.161*** **			
	(0.0506)	(0.0474)	(0.0470)			
CGDPG				**-0.0515*** **	**-0.0265**	**-0.0345** **
				(0.0159)	(0.0176)	(0.0165)
Constant	-0.0160	**0.289*** **	**0.114*** **	-0.0114	**0.276*** **	**0.101*** **
	(0.0584)	(0.0732)	(0.0248)	(0.0591)	(0.0744)	(0.0260)
Obs.	2761	2761	2761	2744	2744	2744
R2		0.453			0.456	
Nb. of mfiid	791	791	791	786	786	786
Country FE	YES	YES	YES	YES	YES	YES
AR(1)	0.000			0.000		
AR(2)	0.623			0.611		
Hansen Test	0.124			0.114		

Standard errors in parentheses

Table 6: Business-cyclical behavior of MFIs' capital ratios by ownership type and regulation status

This table presents the system-GMM dynamic adjustment estimates of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Regulation status		**Ownership type**		
VARIABLES	Regulated	Non-regulated	NGO	BANK	CU/COOP
L.CAR	0.888***	0.896***	0.874***	0.909***	1.028***
	(0.0317)	(0.0462)	(0.0482)	(0.0732)	(0.0120)
L.SIZE	0.00297**	0.00123	-0.000987	0.00343	0.00169
	(0.00142)	(0.00244)	(0.00252)	(0.00362)	(0.00267)
L.PAR30	0.0676**	0.0490	0.0653	0.0588	-0.0555
	(0.0306)	(0.0548)	(0.0567)	(0.0417)	(0.0663)
L.ROA	-0.107	0.0139	0.0154	-0.00733	-0.0380
	(0.0836)	(0.0574)	(0.0542)	(0.0904)	(0.0568)
LO	0.00686*	-0.00327	-0.00126	0.00567	0.00891
	(0.00374)	(0.00695)	(0.00594)	(0.00526)	(0.00904)
DEPTH	-0.00194	-0.0104	-0.00868	-0.00217	-0.00330
	(0.00186)	(0.0105)	(0.00722)	(0.00310)	(0.00319)
GDPG	**-0.154*** **	**-0.144**	**0.0144**	**-0.287*** **	**0.0106**
	(0.0519)	(0.107)	(0.0979)	(0.0699)	(0.100)
Constant	-0.0451	0.0428	0.0484	-0.0421	-0.0739
	(0.0300)	(0.0627)	(0.0545)	(0.0538)	(0.0452)
Obs.	1862	899	992	1443	326
Nb. of mfiid	526	265	291	394	106
Country FE	YES	YES	YES	YES	YES
AR(1)	0.006	0.002	0.001	0.003	0.001
AR(2)	0.415	0.828	0.551	0.316	0.926
Hansen Test	0.202	0.585	0.328	0.729	0.392

Standard errors in parentheses

Table 7: Credit-cyclical behavior of MFIs' capital ratios by ownership type and regulation status

This table presents the system-GMM dynamic adjustment estimates of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the credit-to-GDP growth (CGDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Regulation status		**Ownership type**		
VARIABLES	Regulated	Non-regulated	NGO	BANK	CU/COOP
L.CAR	**0.887*** **	**0.907*** **	**0.874*** **	**0.866*** **	**1.024*** **
	(0.0349)	(0.0386)	(0.0474)	(0.0741)	(0.0118)
L.SIZE	0.00255*	0.000953	-0.00101	0.000660	0.00142
	(0.00140)	(0.00234)	(0.00245)	(0.00373)	(0.00254)
L.PAR30	0.0655**	0.0555	0.0680	0.0458	-0.0274
	(0.0308)	(0.0656)	(0.0588)	(0.0433)	(0.0753)
L.ROA	-0.0539	0.00533	0.00609	0.0388	0.176
	(0.0880)	(0.0598)	(0.0393)	(0.0941)	(0.261)
LO	0.00756*	-0.00251	-0.00115	0.00742	0.00584
	(0.00400)	(0.00746)	(0.00624)	(0.00630)	(0.0105)
DEPTH	-0.00119	-0.0118	-0.00731	-0.00269	-0.00241
	(0.00189)	(0.0140)	(0.00680)	(0.00333)	(0.00355)
CGDPG	**-0.0505*** **	**-0.0552** **	**-0.0279**	**-0.0414** **	**-0.0936***
	(0.0181)	(0.0280)	(0.0333)	(0.0189)	(0.0486)
Constant	-0.0516	0.0317	0.0495	-0.0257	-0.0545
	(0.0332)	(0.0622)	(0.0568)	(0.0560)	(0.0536)
Obs.	1849	895	989	1431	324
Nb. of mfiid	523	263	289	392	105
Country FE	YES	YES	YES	YES	YES
AR(1)	0.0000	0.0030	0.0010	0.0020	0.0050
AR(2)	0.9320	0.1900	0.5140	0.8840	0.5290
Hansen	0.2880	0.5410	0.3620	0.4270	0.1280

Standard errors in parentheses

Table 8: Static regression of MFIs' asset growth on the business cycle variable

This table presents the static estimation (fixed and random effects estimates) of the MFIs' asset growth by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the asset growth (ASSG), is measured as the MFI's asset growth rate. **MFI-level variables** include: the size of the MFI (SIZE), measured by the natural logarithm of the number of total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Fixed effects model						Random effects model					
VARIABLES	**Reg.**	**Non-reg.**	All	BANK	NGO	CU/COOP	**Reg.**	**Non-reg.**	All	BANK	NGO	CU/COOP
L. ASSG	0.0341	0.112	0.0587*	0.0182	0.133**	0.121	0.224***	0.383***	0.272***	0.258***	0.287***	0.238***
	(0.0374)	(0.0697)	(0.0329)	(0.0419)	(0.0628)	(0.0931)	(0.0377)	(0.0647)	(0.0333)	(0.0393)	(0.0729)	(0.0778)
L.SIZE	-0.171***	-0.195***	-0.176***	-0.183***	-0.166***	-0.115***	-0.0286***	-0.012**	-0.0191***	-0.0281***	-0.0101*	-0.0399***
	(0.0177)	(0.0340)	(0.0158)	(0.0197)	(0.0318)	(0.0300)	(0.00475)	(0.00614)	(0.00359)	(0.00615)	(0.00603)	(0.00969)
L.PAR30	-0.538**	-0.650***	-0.606***	-0.519*	-0.696**	0.382	-0.419***	-0.341**	-0.396***	-0.434***	-0.45***	-0.0790
	(0.258)	(0.197)	(0.202)	(0.267)	(0.295)	(0.522)	(0.0945)	(0.151)	(0.0811)	(0.105)	(0.149)	(0.324)
L.ROA	0.109	-0.524	-0.193	0.181	-0.110	-1.291***	-0.105	-0.136**	-0.145*	-0.0523	-0.0853	-1.092***
	(0.298)	(0.359)	(0.274)	(0.318)	(0.320)	(0.220)	(0.226)	(0.0670)	(0.0783)	(0.230)	(0.0589)	(0.146)
LO	0.0566***	-0.0231	0.0459***	0.0547***	0.00454	0.0343	0.00354	0.0402*	0.0114	0.0198	0.0149	0.0138
	(0.0171)	(0.0489)	(0.0159)	(0.0182)	(0.0378)	(0.0625)	(0.0145)	(0.0217)	(0.0115)	(0.0155)	(0.0231)	(0.0269)
DEPTH	0.0301**	0.0578***	0.0338***	0.0308**	0.0498***	0.0197	0.00420	0.0154	0.0113***	0.0103**	0.00946	0.00780
	(0.0120)	(0.0160)	(0.0109)	(0.0135)	(0.0132)	(0.0454)	(0.00449)	(0.0149)	(0.00407)	(0.00479)	(0.00966)	(0.0109)
GDPG	**1.272*** **	**0.822** **	**1.180*** **	**1.373*** **	**0.883*** **	**0.376**	**1.632*** **	**0.852*** **	**1.540*** **	**1.795*** **	**1.049*** **	**0.841*** **
	(0.151)	(0.343)	(0.141)	(0.183)	(0.246)	(0.428)	(0.142)	(0.282)	(0.131)	(0.172)	(0.253)	(0.238)
Constant	1.626***	2.146***	1.693***	1.783***	1.771***	1.006*	0.412***	-0.0278	0.238***	0.293***	0.133	0.427**
	(0.186)	(0.476)	(0.175)	(0.207)	(0.409)	(0.508)	(0.0866)	(0.101)	(0.0640)	(0.0812)	(0.125)	(0.186)
Obs.	1417	648	2065	1106	714	245	1417	648	2065	1106	714	245
R2	0.243	0.263	0.241	0.262	0.237	0.266						
Country FE	411	209	620	328	213	79	411	209	620	328	213	79

Table 9: Static regression of MFIs' equity growth on the business cycle variable

This table presents the static estimation (fixed and random effects estimates) of the MFIs' equity capital growth by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the equity capital growth (EQG), is measured as the MFI's equity growth rate. **MFI-level variables** include: SIZE, measured by the natural logarithm of the number of total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Fixed effects model						Random effects model					
VARIABLES	**Reg.**	**Non-reg.**	All	BANK	NGO	CU/COOP	**Reg.**	**Non-reg.**	All	BANK	NGO	CU/COOP
L. EQG	-0.136*	0.0750	-0.0814	-0.136	0.0110	0.187	-0.0174	0.116	0.0313	-0.00196	0.117	0.209**
	(0.0793)	(0.0752)	(0.0636)	(0.0838)	(0.0916)	(0.130)	(0.0643)	(0.0736)	(0.0489)	(0.0578)	(0.0853)	(0.0942)
L.SIZE	-0.120***	-0.0885*	-0.117***	-0.135***	-0.0848**	-0.0398	-0.0140**	-0.00606	-0.00832*	-0.00840	-0.00527	-0.0388***
	(0.0226)	(0.0462)	(0.0212)	(0.0260)	(0.0349)	(0.0426)	(0.00594)	(0.00807)	(0.00472)	(0.00792)	(0.00736)	(0.0150)
L.PAR30	-0.546	-0.773**	-0.625*	-0.198	-0.698	-1.282	-0.293**	-0.594**	-0.334**	-0.310**	-0.413	-0.803
	(0.442)	(0.317)	(0.329)	(0.302)	(0.470)	(0.834)	(0.149)	(0.233)	(0.130)	(0.135)	(0.316)	(0.513)
L.ROA	0.126	-0.822	-0.351	0.179	0.0100	-2.050***	-0.0983	-0.123	-0.138	-0.142	0.0459	-1.939***
	(0.502)	(0.713)	(0.497)	(0.619)	(0.496)	(0.381)	(0.407)	(0.167)	(0.161)	(0.418)	(0.115)	(0.308)
LO	0.0229	0.0189	0.0214	0.0327	-0.00733	-0.0351	0.0206	0.0374	0.0241*	0.0274	0.0253	0.0286
	(0.0211)	(0.0638)	(0.0207)	(0.0218)	(0.0586)	(0.0489)	(0.0164)	(0.0326)	(0.0144)	(0.0186)	(0.0306)	(0.0498)
DEPTH	-0.0238	0.0227	-0.0154	-0.0347*	0.0276	0.0534	0.00221	0.0123	0.00652	0.00622	0.00370	0.0169**
	(0.0194)	(0.0208)	(0.0166)	(0.0191)	(0.0191)	(0.0807)	(0.00729)	(0.0184)	(0.00601)	(0.00819)	(0.0101)	(0.00838)
GDPG	0.423*	0.472	0.426**	0.191	0.814***	0.136	0.830***	0.657*	0.825***	0.787***	0.946***	0.531
	(0.231)	(0.418)	(0.202)	(0.289)	(0.278)	(0.653)	(0.207)	(0.362)	(0.179)	(0.246)	(0.283)	(0.398)
Constant	1.381***	0.938*	1.320***	1.511***	1.048**	0.783*	0.236**	0.0149	0.136	0.147	0.0537	0.370
	(0.267)	(0.536)	(0.249)	(0.311)	(0.417)	(0.430)	(0.109)	(0.168)	(0.0873)	(0.108)	(0.173)	(0.241)
Obs.	1409	645	2054	1100	710	244	1409	645	2054	1100	710	244
Country FE	0.076	0.063	0.059	0.070	0.068	0.338						
	408	209	617	326	212	79	408	209	617	326	212	79

Table 10: Quantile regression (50%) of MFIs' equity growth and asset growth on the business cycle variable

This table presents the 50% quantile regression of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** equity growth (EQG), is measured as the MFI's equity growth rate, and the asset growth (ASSG) is measured as the MFI's asset growth rate. **MFI-level variables** include: SIZE, measured by the natural logarithm of the number of total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Equity growth (EQG), quantile (0.5)						Asset growth (ASSG), quantile (0.5)					
VARIABLES	**Reg.**	**Non-reg.**	All	BANK	NGO	CU/COOP	**Reg.**	**Non-reg.**	All	BANK	NGO	CU/COOP
L. EQG	0.169***	0.222***	0.205***	0.109***	0.320***	0.405***	0.363***	0.387***	0.366***	0.349***	0.389***	0.472***
	(0.0173)	(0.0183)	(0.0133)	(0.0170)	(0.0191)	(0.0545)	(0.0199)	(0.0313)	(0.0167)	(0.0218)	(0.0298)	(0.0630)
L.SIZE	-0.00429	0.00824	0.00405	0.00139	0.0129***	-0.00948	-0.0100***	-0.00029	-0.00341	-0.0136***	0.00340	-0.0267***
	(0.00399)	(0.00509)	(0.00315)	(0.00527)	(0.00371)	(0.00876)	(0.00361)	(0.00527)	(0.00287)	(0.00483)	(0.00413)	(0.00915)
L.PAR30	-0.0491	-0.432***	-0.122	-0.112	-0.235**	-0.577*	-0.177**	-0.290*	-0.215***	-0.298***	-0.196*	0.378
	(0.0907)	(0.147)	(0.0781)	(0.103)	(0.104)	(0.313)	(0.0830)	(0.156)	(0.0722)	(0.0960)	(0.117)	(0.333)
L.ROA	0.524***	0.0798	0.135**	0.662***	0.0173	-1.889***	0.230*	-0.121**	-0.118**	0.282**	-0.118*	-0.763***
	(0.138)	(0.0594)	(0.0634)	(0.150)	(0.0550)	(0.188)	(0.125)	(0.0618)	(0.0580)	(0.138)	(0.0611)	(0.207)
LO	0.000271	0.0258*	0.00735	-0.00710	0.00155	-0.0182	-0.000129	0.0124	0.0113	0.0113	-0.00161	0.0179
	(0.0116)	(0.0156)	(0.00961)	(0.0141)	(0.0134)	(0.0240)	(0.0105)	(0.0162)	(0.00878)	(0.0130)	(0.0148)	(0.0250)
DEPTH	0.00577	0.00898	0.00825	0.00621	0.00670	0.0210	0.0124**	0.00158	0.0177***	0.0142**	0.00366	0.00614
	(0.00622)	(0.0118)	(0.00543)	(0.00699)	(0.00968)	(0.0133)	(0.00562)	(0.0123)	(0.00495)	(0.00646)	(0.0108)	(0.0134)
GDPG	**0.547*** **	**0.480** **	**0.572*** **	**0.616*** **	**0.652*** **	**0.718*** **	**1.228*** **	**0.608** **	**1.085*** **	**1.346*** **	**0.713*** **	**0.664** **
	(0.155)	(0.238)	(0.131)	(0.175)	(0.207)	(0.274)	(0.140)	(0.246)	(0.120)	(0.162)	(0.229)	(0.288)
Constant	0.153**	-0.124	0.0221	0.129*	-0.0494	0.307**	0.178***	0.0190	0.0513	0.152**	0.0604	0.217
	(0.0714)	(0.0870)	(0.0566)	(0.0760)	(0.0795)	(0.155)	(0.0650)	(0.0907)	(0.0519)	(0.0704)	(0.0885)	(0.162)
Obs.	1409	645	2054	1100	710	244	1417	648	2065	1106	714	245

Table 11: Regression of MFIs' capital ratios by period (pre-crisis, crisis, post-crisis)

This table presents the system-GMM estimates of the capital-to-assets ratio among MFIs for three different time periods: **pre-crisis, crisis, post-crisis**. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable** is the capital-to-assets ratio. **MFI-level variables** include: SIZE, measured by the natural logarithm of the total active borrowers; the capital adequacy ratio (CAR) measured by the equity-to-assets ratio; the portfolio at risk at 30 days (PAR30) measured by the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the logarithm of the number of borrowers per loan officer (LO) captures the quality of monitoring; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **Macroeconomics variables** include: the credit-to-GDP growth (CGDPG) and the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Business cycle (GDPG)			**Credit cycle (CGDPG)**		
VARIABLES	**Before 2007**	**2008-2009**	**2010 and after**	**Before 2007**	**2008-2009**	**2010 and after**
L.CAR	**0.843*** **	**0.939*** **	**0.993*** **	**0.817*** **	**0.907*** **	**0.968*** **
	(0.0433)	(0.0485)	(0.0469)	(0.0449)	(0.0553)	(0.0428)
L.SIZE	0.00185	-0.000218	0.00280*	-0.00132	-0.000662	0.00333**
	(0.00375)	(0.00265)	(0.00159)	(0.00331)	(0.00253)	(0.00150)
L.PAR30	-0.00171	-0.00213	0.0777**	0.0117	0.0585	0.0776**
	(0.0506)	(0.0803)	(0.0361)	(0.0544)	(0.0692)	(0.0352)
L.ROA	0.0313	0.0590	-0.0394	0.100	0.0973	-0.0378
	(0.0930)	(0.0585)	(0.0272)	(0.0836)	(0.0864)	(0.0256)
LO	-0.0156	0.0417**	0.00259	0.00431	0.0191	0.00113
	(0.0159)	(0.0172)	(0.0112)	(0.0155)	(0.0170)	(0.0106)
DEPTH	-0.00594	0.0111**	-0.00423	-0.00148	0.00556	-0.00478
	(0.00422)	(0.00535)	(0.00458)	(0.00399)	(0.00563)	(0.00460)
GDPG	**-0.495** **	**-0.842*** **	**0.283**			
	(0.197)	(0.250)	(0.251)			
CGDPG				**-0.0643** **	**-0.0923** **	**-0.00896**
				(0.0268)	(0.0416)	(0.0218)
Constant	0.124	-0.204**	-0.0614	0.0203	-0.0912	-0.0370
	(0.0873)	(0.0946)	(0.0858)	(0.0884)	(0.0998)	(0.0805)
Obs.	872	615	1274	866	608	1270
Nb. of mfiid	395	406	556	393	402	554
Country FE	YES	YES	YES	YES	YES	YES
AR(1)	0.006	NA	0.07	0.005	0.006	0.044
AR(2)	0.686	NA	0.128	0.989	NA	0.162
Hansen Test	0.61	NA	0.186	0.735	0.143	0.32

Standard errors in parentheses

NA= Convergence not attained, data length concerns.

Table 12: Static regression of MFIs' capital ratios on the economic variable (GDPG)

This table presents the static estimation (fixed and random effects estimates) of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable**, the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Fixed effects						Random effects					
VARIABLES	**Reg.**	**Non-reg.**	**NGO**	**BANK**	**CU/COOP**	**All**	**Reg.**	**Non-reg.**	**NGO**	**BANK**	**CU/COOP**	**All**
L.SIZE	0.0224***	0.0189**	0.0263***	0.0195***	0.00980	0.0216***	0.00649***	0.00684**	0.00561**	0.00932***	0.000376	0.00619***
	(0.00455)	(0.00929)	(0.00766)	(0.00519)	(0.00921)	(0.00414)	(0.00164)	(0.00269)	(0.00220)	(0.00227)	(0.00360)	(0.00134)
L.PAR30	0.0444	0.0852	0.0738	0.0580	-0.0672	0.0562	0.0631**	0.0755	0.0854**	0.0572	0.00743	0.0621**
	(0.0481)	(0.0680)	(0.0459)	(0.0686)	(0.146)	(0.0393)	(0.0299)	(0.0609)	(0.0431)	(0.0364)	(0.0893)	(0.0276)
L.ROA	-0.115	-0.118	-0.108	-0.0725	-0.359***	-0.118	-0.0346	0.0141	0.00294	0.0563	-0.276***	0.00233
	(0.120)	(0.102)	(0.100)	(0.123)	(0.0916)	(0.0792)	(0.0824)	(0.0374)	(0.0282)	(0.0904)	(0.0783)	(0.0291)
LO	0.00244	5.95e-05	-0.00564	0.00526	-0.00705	0.00206	0.00684*	-2.08e-05	0.00252	0.000442	0.0114	0.00512
	(0.00558)	(0.0160)	(0.0127)	(0.00688)	(0.0126)	(0.00533)	(0.00402)	(0.00873)	(0.00717)	(0.00509)	(0.00976)	(0.00365)
DEPTH	-0.00912	-0.00868	-0.0269	-0.00683	0.00242	-0.00931*	0.000371	-0.00620	-0.00703	6.14e-05	0.00178	-0.00121
	(0.00572)	(0.0117)	(0.0177)	(0.00527)	(0.00944)	(0.00520)	(0.00140)	(0.00566)	(0.00613)	(0.00152)	(0.00284)	(0.00149)
GDPG	**-0.244*** **	**-0.152**	**0.00277**	**-0.351*** **	**-0.101**	**-0.224*** **	**-0.272*** **	**-0.102**	**0.00143**	**-0.370*** **	**-0.0683**	**-0.235*** **
	(0.0626)	(0.162)	(0.134)	(0.0770)	(0.0922)	(0.0602)	(0.0586)	(0.138)	(0.118)	(0.0681)	(0.0975)	(0.0551)
Constant	-0.234***	-0.178*	-0.225***	-0.220***	-0.0433	-0.220***	-0.105***	-0.0715	-0.0786*	-0.0971***	-0.0723	-0.0922***
	(0.0458)	(0.106)	(0.0856)	(0.0538)	(0.107)	(0.0420)	(0.0255)	(0.0463)	(0.0402)	(0.0264)	(0.0493)	(0.0210)
Obs.	1862	899	992	1443	326	2761	1862	899	992	1443	326	2761
R-2	0.048	0.025	0.039	0.051	0.105	0.040						
Nb. of mfiid	526	265	291	394	106	791	526	265	291	394	106	791

Table 13: Static regression of MFIs' capital ratios on the credit cycle variable (CGDPG)

This table presents the static estimation (fixed and random effects estimates) of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG) and the credit-to-GDP growth (CGDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Fixed effects						Random effects					
VARIABLES	**Reg.**	**Non-reg.**	**NGO**	**BANK**	**CU/COOP**	**All**	**Reg.**	**Non-reg.**	**NGO**	**BANK**	**CU/COOP**	**All**
L.SIZE	0.0230***	0.0194**	0.0259***	0.0210***	0.00698	0.0219***	0.00607***	0.00690***	0.00591***	0.00843***	0.000325	0.00589***
	(0.00466)	(0.00974)	(0.00775)	(0.00536)	(0.00815)	(0.00427)	(0.00159)	(0.00266)	(0.00207)	(0.00239)	(0.00354)	(0.00130)
L.PAR30	0.0431	0.0918	0.0688	0.0492	0.0951	0.0586	0.0595**	0.0858	0.0899**	0.0543	0.0468	0.0635**
	(0.0479)	(0.0706)	(0.0465)	(0.0705)	(0.156)	(0.0395)	(0.0297)	(0.0617)	(0.0441)	(0.0371)	(0.0847)	(0.0277)
L.ROA	-0.120	-0.0571	-0.119	-0.0813	0.344	-0.0930	-0.0377	0.0140	-0.0112	0.0557	0.0724	0.00121
	(0.121)	(0.109)	(0.0987)	(0.125)	(0.328)	(0.0811)	(0.0839)	(0.0364)	(0.0191)	(0.0931)	(0.228)	(0.0281)
LO	0.00668	-1.08e-05	-0.00676	0.0132	-0.0112	0.00519	0.00899**	0.000899	0.00361	0.00263	0.00625	0.00685*
	(0.00718)	(0.0163)	(0.0126)	(0.00875)	(0.0131)	(0.00659)	(0.00421)	(0.00878)	(0.00718)	(0.00617)	(0.0111)	(0.00385)
DEPTH	-0.00774	-0.0102	-0.0271	-0.00414	0.0103	-0.00832	0.00142	-0.00551	-0.00590	0.000893	0.00260	-0.000192
	(0.00569)	(0.0109)	(0.0176)	(0.00516)	(0.00897)	(0.00516)	(0.00132)	(0.00564)	(0.00584)	(0.00154)	(0.00305)	(0.00141)
CGDPG	**-0.0343**	**-0.0609**	**-0.0389**	**-0.0363***	**-0.159****	**-0.0398****	**-0.0519****	**-0.0512***	**-0.0259**	**-0.0579*****	**-0.116****	**-0.0510*****
	(0.0231)	(0.0388)	(0.0482)	(0.0216)	(0.0619)	(0.0201)	(0.0211)	(0.0309)	(0.0431)	(0.0193)	(0.0462)	(0.0180)
Constant	-0.275***	-0.190*	-0.212**	-0.298***	-0.0201	-0.252***	-0.125***	-0.0822*	-0.0878**	-0.118***	-0.0500	-0.110***
	(0.0488)	(0.113)	(0.0910)	(0.0565)	(0.103)	(0.0455)	(0.0265)	(0.0467)	(0.0407)	(0.0295)	(0.0527)	(0.0220)
Obs.	1849	895	989	1431	324	2744	1849	895	989	1431	324	2744
R-2	0.038	0.022	0.042	0.033	0.081	0.032						
Nb. of mfiid	523	263	289	392	105	786	523	263	289	392	105	786

Table 14: Quantile regression (50%) of MFIs' capital ratios on the business cycle variables

This table presents the 50% quantile regression of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the number of total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG) and the credit-to-GDP growth (CGDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

VARIABLES	**Reg.**	**Non-reg.**	**NGO**	**BANK**	**CU/COOP**	**All**	**Reg.**	**Non-reg.**	**NGO**	**BANK**	**CU/COOP**	**All**
L.SIZE	0.00278***	0.00442***	0.00322**	0.00472***	0.00174	0.00285***	0.00218***	0.00452***	0.00324***	0.00369***	0.00127	0.00251***
	(0.000632)	(0.00149)	(0.00128)	(0.000980)	(0.00127)	(0.000601)	(0.000584)	(0.00140)	(0.00115)	(0.000919)	(0.00114)	(0.000564)
L.PAR30	0.0354**	0.0975**	0.0796**	0.0302*	0.0262	0.0386***	0.0279**	0.123***	0.0896***	0.0289*	0.0188	0.0296**
	(0.0139)	(0.0404)	(0.0346)	(0.0183)	(0.0426)	(0.0144)	(0.0128)	(0.0377)	(0.0311)	(0.0168)	(0.0380)	(0.0135)
L.ROA	-0.0304*	0.0299**	0.0306**	-0.00868	-0.132***	0.0306***	-0.0283*	0.0296**	0.0299**	0.0166	-0.00533	0.0247***
	(0.0177)	(0.0131)	(0.0137)	(0.0216)	(0.0313)	(0.00905)	(0.0164)	(0.0126)	(0.0125)	(0.0201)	(0.0461)	(0.00867)
LO	0.00254	0.00282	0.00109	0.000871	-0.000145	0.00234	0.00278*	0.00234	0.00292	0.00119	-2.33e-05	0.00253
	(0.00176)	(0.00439)	(0.00432)	(0.00260)	(0.00308)	(0.00176)	(0.00168)	(0.00413)	(0.00390)	(0.00254)	(0.00275)	(0.00170)
DEPTH	-0.000487	-1.59e-05	-0.00320	-0.000158	-0.00120	-0.000733	-0.000247	-0.000111	0.000830	-0.000376	-0.000782	-0.000334
	(0.00101)	(0.00357)	(0.00340)	(0.00133)	(0.00208)	(0.00107)	(0.000941)	(0.00336)	(0.00306)	(0.00126)	(0.00186)	(0.00102)
GDPG	**-0.143*** **	**-0.0431**	**-0.0194**	**-0.234*** **	**0.0130**	**-0.121*** **						
	(0.0251)	(0.0683)	(0.0692)	(0.0332)	(0.0444)	(0.0256)						
CGDPG							**-0.0527*** **	**-0.0524** **	**-0.0378** **	**-0.0476*** **	**-0.116*** **	**-0.0539*** **
							(0.00767)	(0.0234)	(0.0206)	(0.00978)	(0.0246)	(0.00810)
Constant	Constant	-0.0428***	-0.0678***	-0.0464*	-0.0513***	-0.0186	-0.0424***	-0.0676***	-0.0583**	-0.0519***	-0.0125	-0.0460***
		(0.0106)	(0.0246)	(0.0256)	(0.0135)	(0.0199)	(0.00999)	(0.0232)	(0.0231)	(0.0129)	(0.0178)	(0.00975)
Obs.	Obs.	1862	899	992	1443	326	1849	895	989	1431	324	2744
Country FE	Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 15: Quantile regression (25%) of MFIs' capital ratios on the business cycle variables

This table presents the 25% quantile regression of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the number of total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG) and the credit-to-GDP growth (CGDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

VARIABLES	Reg.	Non-reg.	NGO	BANK	CU/COOP	All	Reg.	Non-reg.	NGO	BANK	CU/COOP	All
L.SIZE	0.00600***	0.00612***	0.00707***	0.0124***	0.00518**	0.00633***	0.00477***	0.00572***	0.00673***	0.0107***	0.00527**	0.00569***
	(0.00128)	(0.00226)	(0.00197)	(0.00177)	(0.00238)	(0.00107)	(0.00123)	(0.00212)	(0.00190)	(0.00192)	(0.00217)	(0.00102)
L.PAR30	0.0684**	0.0870	0.0857	0.0754**	-0.0178	0.0707***	0.0706***	0.0761	0.0769	0.0769**	-0.0447	0.0727***
	(0.0280)	(0.0611)	(0.0532)	(0.0330)	(0.0797)	(0.0256)	(0.0269)	(0.0571)	(0.0516)	(0.0351)	(0.0723)	(0.0243)
L.ROA	0.0137	0.0415**	0.0135	0.0840**	-0.210***	0.0363**	0.00726	0.0138	0.0142	0.0811*	-0.0628	0.0160
	(0.0357)	(0.0198)	(0.0211)	(0.0390)	(0.0584)	(0.0161)	(0.0347)	(0.0191)	(0.0207)	(0.0420)	(0.0877)	(0.0157)
LO	0.00554	0.00774	0.00451	-0.0103**	0.0104*	0.00596*	0.00660*	0.00772	0.00606	-0.00679	0.00753	0.00522*
	(0.00356)	(0.00664)	(0.00665)	(0.00471)	(0.00575)	(0.00313)	(0.00355)	(0.00625)	(0.00646)	(0.00530)	(0.00524)	(0.00306)
DEPTH	0.00288	0.00410	0.00147	0.00137	0.00440	0.00308	0.00367*	0.00294	0.00293	0.00237	0.00589*	0.00372**
	(0.00203)	(0.00540)	(0.00522)	(0.00241)	(0.00389)	(0.00190)	(0.00199)	(0.00509)	(0.00507)	(0.00263)	(0.00355)	(0.00184)
GDPG	**-0.335*** **	**-0.190***	**0.0469**	**-0.436*** **	**-0.0221**	**-0.309*** **						
	(0.0508)	(0.103)	(0.106)	(0.0600)	(0.0830)	(0.0456)						
CGDPG							**-0.0865*** **	**-0.0644***	**-0.0596***	**-0.0833*** **	**-0.0978*** **	**-0.0831*** **
							(0.0162)	(0.0355)	(0.0341)	(0.0204)	(0.0468)	(0.0146)
Constant	-0.0428***	-0.0678***	-0.0464*	-0.0513***	-0.0186	-0.0448***	-0.122***	-0.146***	-0.145***	-0.117***	-0.112***	-0.126***
	(0.0106)	(0.0246)	(0.0256)	(0.0135)	(0.0199)	(0.0102)	(0.0211)	(0.0351)	(0.0382)	(0.0269)	(0.0339)	(0.0176)
Obs.	1862	899	992	1443	326	2761	1849	895	989	1431	324	2744
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 16: Quantile regression (75%) of MFIs' capital ratios on the business cycle variables

This table presents the 75% quantile regression of the capital adequacy ratio (CAR) by MFI ownership type and regulation status. Our results are based on an unbalanced panel of 5996 MFI-year observations across a total of 1414 MFIs over the 2001-2014 period. **The dependent variable,** the capital adequacy ratio (CAR), is measured as the total equity over total assets. **MFI-level variables** include: SIZE, measured by the natural logarithm of the number of total active borrowers; the portfolio at risk at 30 days (PAR30) which is the part of the portfolio affected by outstanding payments; the return on assets (ROA) which is the profitability measure; the number of borrowers per loan officer (LO) captures the quality of monitoring and is measured as the logarithm of the number of borrowers per loan officer; and the depth of outreach (DEPTH) variable, which measures the fact that the MFI targets the poorest clients. **The macroeconomic condition** is proxied by the real GDP growth (GDPG) and the credit-to-GDP growth (CGDPG). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

VARIABLES	Reg.	Non-reg.	NGO	BANK	CU/COOP	All	Reg.	Non-reg.	NGO	BANK	CU/COOP	All
L.SIZE	0.000914	0.00198	-0.000306	0.000807	0.000402	0.000548	0.000549	0.00198	-0.000623	-0.000201	0.000542	0.000112
	(0.000671)	(0.00172)	(0.00127)	(0.00114)	(0.00172)	(0.000666)	(0.000709)	(0.00175)	(0.00133)	(0.00112)	(0.00157)	(0.000662)
L.PAR30	0.00192	0.0393	0.130***	-0.0125	0.0154	0.00872	0.00354	0.0825*	0.106***	-0.0159	0.0377	0.00830
	(0.0147)	(0.0467)	(0.0343)	(0.0213)	(0.0575)	(0.0159)	(0.0155)	(0.0472)	(0.0362)	(0.0206)	(0.0523)	(0.0158)
L.ROA	0.0189	0.0441***	0.0420***	0.0246	-0.224***	0.0302***	0.0173	0.0436***	0.0420***	0.0232	0.123*	0.0427***
	(0.0188)	(0.0151)	(0.0136)	(0.0252)	(0.0422)	(0.0100)	(0.0199)	(0.0158)	(0.0145)	(0.0246)	(0.0635)	(0.0102)
LO	-0.00303	-0.000510	0.00246	-0.00160	-0.00403	-0.00211	-0.00154	0.000381	0.00188	0.000814	-0.00564	-0.00196
	(0.00187)	(0.00507)	(0.00428)	(0.00304)	(0.00415)	(0.00195)	(0.00204)	(0.00517)	(0.00453)	(0.00310)	(0.00379)	(0.00199)
DEPTH	-0.00329***	-0.00226	-0.00244	-0.00315**	-0.00333	-0.00357***	-0.00280**	-0.00235	-0.00239	-0.00269*	-0.00319	-0.00338***
	(0.00107)	(0.00413)	(0.00336)	(0.00156)	(0.00280)	(0.00118)	(0.00114)	(0.00420)	(0.00356)	(0.00154)	(0.00257)	(0.00119)
GDPG	**-0.0564****	**-0.128**	**-0.0695**	**-0.123*****	**0.0885**	**-0.0790*****						
	(0.0267)	(0.0788)	(0.0685)	(0.0388)	(0.0600)	(0.0284)						
CGDPG							**-0.0186****	**-0.0233**	**-0.0223**	**-0.0255****	**-0.117*****	**-0.0201****
							(0.00931)	(0.0293)	(0.0239)	(0.0120)	(0.0339)	(0.00952)
Constant	-0.0428***	-0.0678***	-0.0464*	-0.0513***	-0.0186	-0.0448***	0.0193	-8.23e-05	0.0125	0.0160	0.0424*	0.0284**
	(0.0106)	(0.0246)	(0.0256)	(0.0135)	(0.0199)	(0.0102)	(0.0121)	(0.0290)	(0.0268)	(0.0157)	(0.0245)	(0.0115)
Obs.	1862	899	992	1443	326	2761	1849	895	989	1431	324	2744
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Figure 1: Dynamics of MFIs' capital ratio variations and economic growth

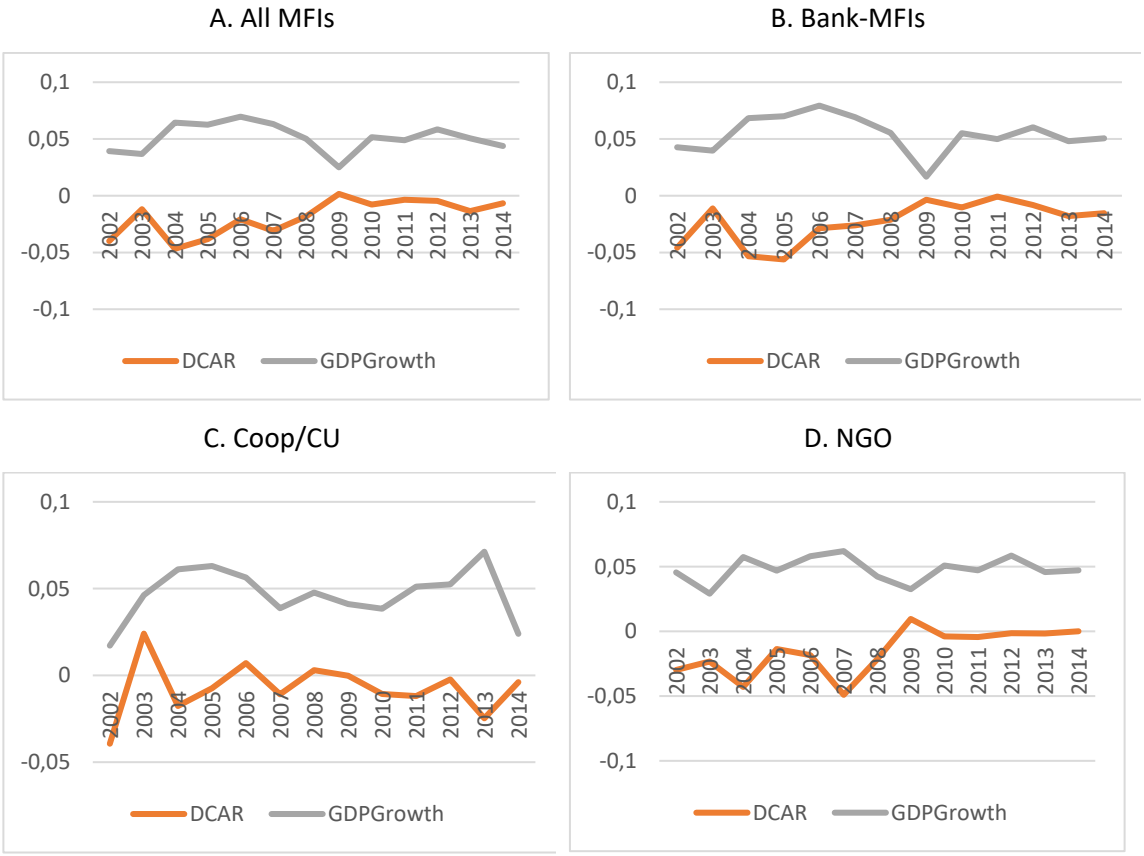
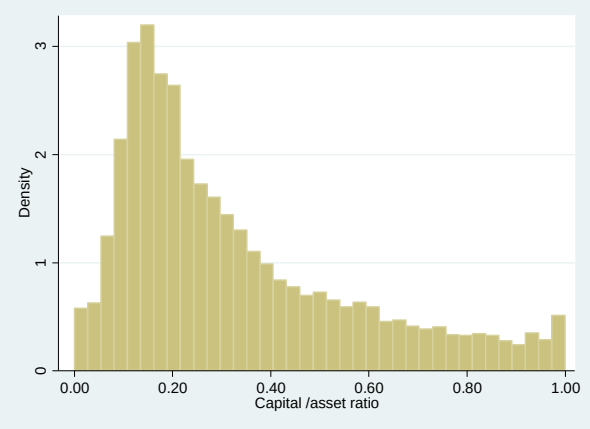


Figure 2: Frequency of the capital-to-assets ratios (CAR) (2001-2014)

A. Frequency of the CAR across the whole sample



B. Frequency of the CAR for 2001, 2007 and 2014

2001 **2007** **2014**

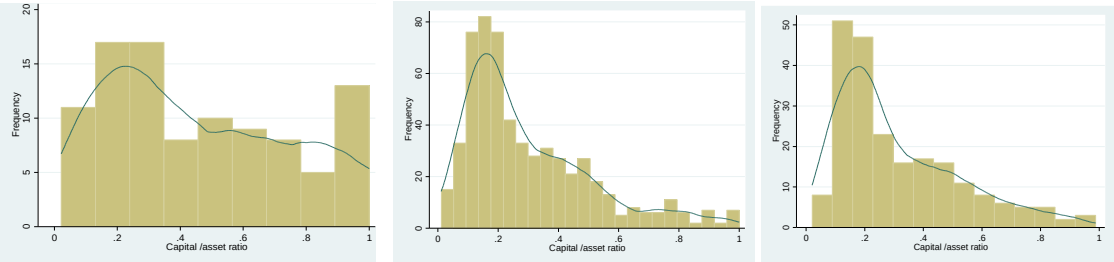
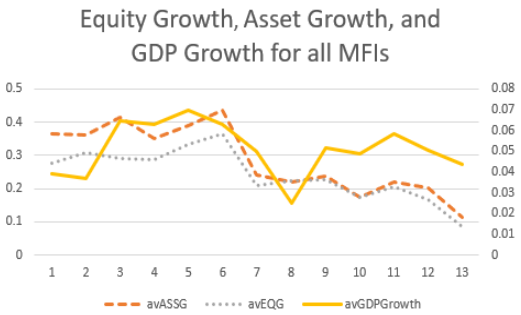


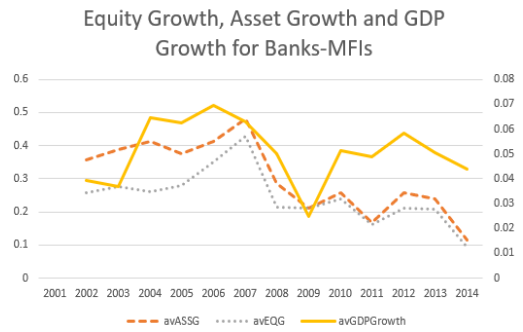
Figure 3: Dynamics of equity growth, asset growth and GDP growth (2001-2014)

The graphs below plot the dynamics of equity growth and asset growth jointly with the business cycle variable (the GDP growth). The main objective in plotting these graphs is to decompose the cyclical dynamic of the capital ratio through its numerator (equity growth) and denominator (asset growth). Panel A describes the relationship for the whole sample. Panels B, C & D give the plots by MFI ownership type, while Panels E & F provide the plots by MFI regulation status.

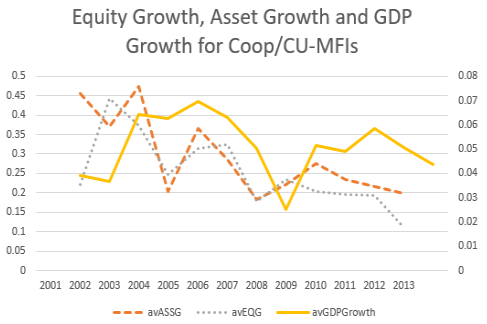
A. All MFIs



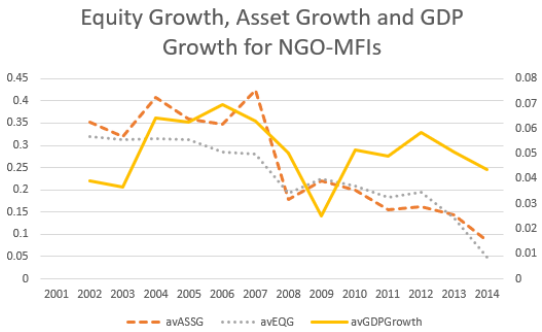
B. Bank-MFIs



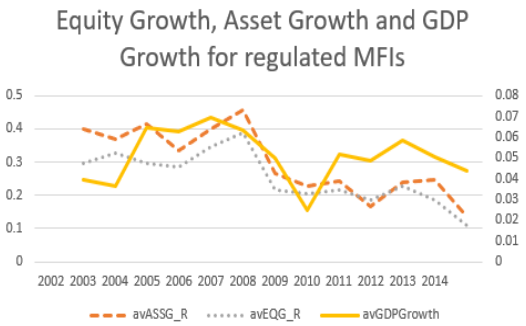
C. Coop/CU-MFIs



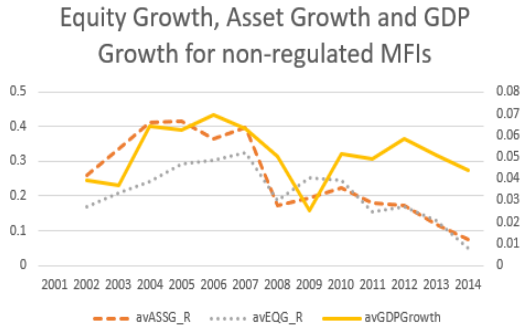
D. NGO-MFIs



E. Regulated MFIs



F. Non-regulated MFIs



Appendix 1:

Country	Obs.	Percent	Country	Obs.	Percent
Afghanistan	26	0.43	Macedonia	32	0.53
Albania	36	0.60	Madagascar	35	0.58
Angola	5	0.08	Malawi	23	0.38
Argentina	52	0.87	Malaysia	2	0.03
Armenia	75	1.25	Mali	41	0.68
Azerbaijan	106	1.77	Mexico	137	2.28
Bangladesh	230	3.84	Moldova	18	0.30
Belize	2	0.03	Mongolia	41	0.68
Benin	56	0.93	Montenegro	10	0.17
Bhutan	3	0.05	Morocco	48	0.80
Bolivia	185	3.09	Mozambique	37	0.62
Bosnia and Herzegovina	90	1.50	Myanmar (Burma)	1	0.02
Brazil	106	1.77	Namibia	1	0.02
Bulgaria	32	0.53	Nepal	168	2.80
Burkina Faso	14	0.23	Nicaragua	184	3.07
Burundi	6	0.10	Niger	11	0.18
Cambodia	119	1.98	Nigeria	46	0.77
Cameroon	36	0.60	Pakistan	115	1.92
Central African Republic	1	0.02	Palestine	25	0.42
Chad	5	0.08	Panama	29	0.48
Chile	23	0.38	Papua New Guinea	5	0.08
China, People's Republic of	18	0.30	Paraguay	54	0.90
Colombia	165	2.75	Peru	289	4.82
Congo, Democratic Republic of the	26	0.43	Philippines	301	5.02
Congo, Republic of the	8	0.13	Poland	13	0.22
Costa Rica	86	1.43	Romania	30	0.50
Cote d'Ivoire (Ivory Coast)	7	0.12	Russia	56	0.93
Croatia	7	0.12	Rwanda	21	0.35
Dominican Republic	59	0.98	Samoa	4	0.07
East Timor	10	0.17	Senegal	46	0.77
Ecuador	422	7.04	Serbia	28	0.47
Egypt	60	1.00	Sierra Leone	11	0.18
El Salvador	117	1.95	South Africa	24	0.40
Ethiopia	83	1.38	Sri Lanka	48	0.80
Gambia, The	3	0.05	Sudan	2	0.03
Georgia	65	1.08	Suriname	5	0.08
Ghana	72	1.20	Swaziland	1	0.02
Grenada	1	0.02	Syria	6	0.10
Guatemala	120	2.00	Tajikistan	93	1.55
Guinea	5	0.08	Tanzania	47	0.78

Guyana	1	0.02	Thailand	7	0.12
Haiti	25	0.42	Togo	34	0.57
Honduras	128	2.13	Tonga	6	0.10
Hungary	3	0.05	Trinidad and Tobago	3	0.05
India	482	8.04	Tunisia	13	0.22
Indonesia	73	1.22	Turkey	4	0.07
Iraq	12	0.20	Uganda	70	1.17
Jamaica	1	0.02	Ukraine	13	0.22
Jordan	53	0.88	Uruguay	5	0.08
Kazakhstan	59	0.98	Uzbekistan	25	0.42
Kenya	76	1.27	Venezuela	9	0.15
Kosovo	62	1.03	Vietnam	55	0.92
Kyrgyzstan	75	1.25	Yemen	16	0.27
Laos	13	0.22	Zambia	15	0.25
Lebanon	21	0.35	Zimbabwe	7	0.12
			Total	5996	100.00