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**Buffer Capital, Loan Portfolio Quality and the Performance of Microfinance
Institutions: A Global Analysis**

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Buffer Capital, Loan Portfolio Quality and the Performance of Microfinance

Institutions: A Global Analysis

Abstract

Using a sample of 625 microfinance institutions (MFI) across 40 countries from 2010-2015, we empirically examine the effect of buffer capital on the performance of MFIs and how this effect varies with loan portfolio quality. We find a negative relationship between buffer capital and MFIs' performance. We further document that loan portfolio quality positively moderates the buffer capital-MFI performance relationship. We demonstrate that the buffer capital-loan portfolio quality relationship does not vary for deposit-taking, profit-making, and regulated MFIs. Our findings shed new light on the value relevance of capital in microfinance institutions. We use a novel approach to evaluate our results in light of the effects of omitted variable bias.

Keywords: Buffer capital, microfinance institutions, performance, loan portfolio quality

1. Introduction

The capital requirement in financial institutions has become a contentious issue. Regulators and the public argue that financial institutions should hold higher levels of capital because of the externalities associated with the safety net provided to them (Berger and Bouwman, 2013). Thus, holding more capital can lead to an improvement in social efficiency. In contrast, practitioners argue that holding high levels of capital will reduce operations (Berger and Bouwman, 2013). Due to these divergent views, several studies have investigated the effect of capital on the performance of financial institutions (Diamond and Rajan, 2001; Osborne et al., 2012; Lee et al., 2015). However, a critical part of the financial sector that has received little attention in the literature is microfinance institutions (MFIs).

MFIs have become the backbone of countries around the world (Bogan, 2012). In fact, in most developing countries, MFIs typify the banking prototype that people seek. Nonetheless, a major challenge facing the microfinance sector is capital (Bogan, 2012; Dorfleitner et al., 2016). Unlike traditional banks, most MFIs do not have access to debt (Dorfleitner et al., 2016) and deposits (Galema et al., 2011). Indeed, only the very big and well-established MFIs have access to debt finance (Bogan, 2012). Further, according to the Basel Committee on Banking Supervision (2010), just about 5% of MFIs take deposits. Although credit-only MFIs that do not take deposits are not subject to prudential regulations, their regulatory mechanisms include capital adequacy requirements. The capital adequacy requirements are meant to measure MFIs' resilience to losses (Tchakoute-Tchuigoua, 2016). Consequently, the lack of deposits and debt capital induce most MFIs to rely on owners' equity, donations, grants, and subsidised equity to be able to allocate loans and fund their projects (Minton and Schrand, 1999; Schaeck and Cihak, 2012; Tchakoute-Tchuigoua, 2014). In fact, donations and grants constitute the main funding source of most MFIs. However, despite their reliance on donations and grants, some

MFIs hold buffer capital: capital in excess of the minimum capital requirement. We examine whether buffer capital has performance effects in MFIs.

A major idiosyncratic characteristic of MFIs is poor loan portfolio quality. MFIs primarily focus on the provision of financial services (credit and savings) to the poor, low-income persons and informal businesses (Becchetti and Castriota, 2011; Rai and Ravi, 2011). As a result, they have a risky clientele profile because they serve informationally opaque borrowers (Berger and Black, 2011). This exposes them to a higher credit risk leading to poor loan portfolio quality (Tchakoute-Tchuigoua, 2016). However, because the loan portfolio is by far the largest asset of an MFI, risks associated with it can have debilitating consequences (Yimga, 2016). Nevertheless, buffer capital insulates MFIs against survival threats posed by poor loan portfolio quality (Tchakoute-Tchuigoua, 2016). Thus, higher buffer capital may be necessary to make MFIs operationally self-sufficient in the midst of deteriorating loan portfolio quality. Consequently, Tchakoute-Tchuigoua (2016) suggests that the buffer capital requirements of MFIs may vary due to differences in the level of loan portfolio quality. We consider how loan portfolio quality affects the buffer capital-MFI performance relationship.

In addressing these questions, we also present a sketch showing the evolution of buffer capital and loan portfolio quality over the sample period. As shown in Figure 1, buffer capital and loan portfolio losses seemed to diverge. However, they later converged in a way that supports Tchakoute-Tchuigoua's (2016) argument regarding the connection between buffer capital and loan portfolio loss.

[Insert Figure 1]

Using a sample of 625 MFIs across 40 countries for the period 2010 to 2015, we find that buffer capital is value decreasing in microfinance institutions. Nevertheless, loan portfolio quality positively moderates the buffer capital-MFI performance relationship. Further analyses reveal that the buffer capital-performance relationship does not change for deposit-taking,

profit-making, and regulated MFIs. We offer alternative explanations for these results. Our results are robust to endogeneity and a battery of other robustness tests.

Our study makes several contributions to the literature. First, studies relating to the capital of financial institutions to date have mainly focused on traditional banks (Osborne et al. 2012; Berger and Bouwman, 2013; Guidara et al., 2013; Lee et al., 2015). MFIs are different because unlike traditional banks, MFIs mostly have limited access to deposits and debts. They predominantly rely on donations, grants and subsidised equity (Hudon and Traca, 2011; Tchakoute-Tchuigoua, 2016). These sources of funds are difficult to come by and donors, as well as providers of grants and subsidised equity mostly demand that certain social objectives are met (Bos and Millone, 2015). Unlike traditional banks where providers of capital expect a financial return, MFIs' access to funds may lead to the pursuance of other social activities which may not necessarily be performance enhancing. Due to this, existing studies suggest that increased use of subsidies (Hudon and Traca, 2011) and grants (Bogan, 2012) reduces the performance of MFIs. Thus, the buffer capital-performance relationship in MFIs may differ from that of traditional banks. We contribute to the literature by providing evidence that buffer capital reduces performance in MFIs.

Second, we extend prior studies on the capital requirements of financial institutions by investigating how loan portfolio quality affects the value relevance of buffer capital. Existing literature documents that although higher capital requirements may be expensive for MFIs, buffer capital helps to absorb loan losses (Boyd and De Nicolo, 2005). Indeed, Tchakoute-Tchuigoua (2016) suggest that differences in loan portfolio quality explain the level of buffer capital kept by MFIs but their study fell short of investigating how these affect the value relevance of buffer capital. Our study fills this gap in the literature by documenting that poor loan portfolio quality positively moderates the buffer capital-MFI performance relationship.

This increases our understanding of how the value relevance of buffer capital might differ among MFIs with different characteristics.

The remainder of the paper is organised as follows. Section 2 presents a review of the background of MFIs. Section 3 reviews the empirical literature and hypotheses development. Section 4 develops the research methodology. The main results are presented in section 5. Robustness tests are presented in sections 6. Section 7 concludes the paper.

2. Background – Performance Implications of MFI Funding Sources

The microfinance industry is growing at a fast pace worldwide, serving around 115 million people (Dichter, 1999). MFIs promise to reduce poverty in low income communities by employing profit-making banking practices (Cull et al., 2007). Consequently, they have a duality of purpose premised on social impact and financial viability logics (Yunus, 2008). Within the social impact logic, they are expected to be critical to poverty alleviation and financial inclusion imperatives in their countries of operation. This may include the provision of financial services (credit and savings) to the poor, low-income persons and informal businesses, as well as making lending and recruitment policies that favour a particular group of people in society such as women (Becchetti and Castriota, 2011; D'Espallier et al., 2011; Rai and Ravi, 2011).

More so, within the banking logic, MFIs are expected to operate in a way that is sustainable, financially viable and operationally self-sufficient (profitable) through the adoption of responsible banking principles that enhance profitability (Allet, 2014; Servet, 2006; Yunus, 2008). Thus, MFIs are expected to exhibit financial accountability through improved profitability in a way that makes them operationally self-sufficient (Allet, 2014).

Double-bottomline or hybridized operations also make funding a major challenge for MFIs (D'Espallier et al., 2013; Tcguigoua, 2017; Battilana and Dorado, 2010; Kent and Dacin,

2013). This is because although funding sources for MFIs include grants, donations, debts, equity and deposits, most MFIs neither take deposits nor have access to the debt market, leaving grants, donations, and equity as the main funding sources (Tchakoute-Tchuigoua, 2010). However, the hybridized operations incentivize most donors and providers of grants to impose further conditions on the MFIs they fund that further tilts their operations to one of the dual objectives. For example, although traditional banks strive to avoid risky borrowers (Faleye and Krishnan, 2011), donors and funders such as the IMF and the World Bank require MFIs to deepen their pro-poor banking strategy and target risky borrowers excluded by traditional banks, often driven by the need to enhance access to finance (Strom et al., 2014; Gupta, 2014). Further, motivated by funders, MFIs in the Women's World Banking network adopt lending and recruitment policies to achieve gender equality objectives rather than profitability. Similarly, Jia et al. (2016) report that commercial funders pressure MFIs to focus more on the banking and profitability logic.

Indeed, a banking model based on giving uncollateralised loans to the poor in low income communities with high information asymmetry, while making recruitment decisions based on reasons other than skills and qualifications, may threaten MFIs' profitability and operational self-sufficiency (Besley, 1995; Cull et al., 2007; Strom et al., 2014; Gupta, 2014). Accordingly, some studies argue that the social objective of MFIs threatens operational self-sufficiency and profitability. In fact, Paxton et al. (2000) report that there is a trade-off between the social objective and MFIs' financial sustainability. A survey by the Microbanking Bulletin (2007) showed that 41% of MFIs are not self-sustainable. Lopatta et al. (2017) attribute this to the focus on social logic, arguing that there is a negative relationship between financial and social logic. There is also evidence that only a few MFIs have managed to survive without donations and grants (Hudon and Traca, 2011; Tchakoute-Tchuigoua, 2014). Indeed,

D'Espallier et al. (2013) indicate that only about 23% of MFIs worldwide can survive without subsidies and grants.

3. Literature Review and Hypotheses Development

3.1 Buffer capital and MFIs' performance

Few studies have examined the relationship between buffer capital and MFIs' performance. Bogan (2012) examined the effect of changes in MFIs capital structure on performance using data from MFIs in Africa, East Asia, Eastern Europe, Latin America, the Middle East, and South Asia. The study finds that increased use of grants decrease performance. Hudon and Traca (2011) investigated the effect of subsidies on MFIs' performance. They reported that subsidies are good for MFIs but over subsidisation decreases performance. Others including Paxton et al. (2000) and Lopatta et al (2017) reported a trade-off between the financial and social objectives of MFIs. Thus, although MFIs mainly rely on grants and subsidies (Tchakoute-Tchuigoua, 2016), providers of grants and subsidies may influence MFIs to focus more on their social objectives. Therefore, these studies suggest that raising capital through grants and subsidies can be value-decreasing in MFIs.

According to the trade-off theory, an optimal capital that trades off costs and benefits should enhance performance (Berger et al., 1995; Osborne et al., 2012). However, the capital adequacy requirement imposed by regulators means MFIs may not operate at the optimal capital and this may affect performance. To reduce the risk of going below the capital adequacy ratio, MFIs may keep buffer capital. A study by Tchakoute-Tchuigoua (2016) recorded the average buffer capital of the MFIs in his sample to be around 21%. The holding of buffer capital is expected to be costly to MFIs; it represents an opportunity cost because the amount could be invested in a profitable venture to generate income (Goddard et al., 2013). Thus, the holding of buffer capital constrains MFIs operations. Based on these, we hypothesise that:

H1. Buffer capital is negatively associated with MFIs' performance

3.2 Buffer Capital, Loan Portfolio Quality and MFI Performance.

Loan portfolio quality which represents the loan portfolio at risk of non-payment by clients is expected to affect the value relevance of buffer capital. A deterioration in loan portfolio quality will lead to a reduction in income (Peek and Rosengren, 1995; Christen et al., 2012) due to loan losses (Osborne et al., 2012). This has the effect of reducing the performance level of an MFI (Floro, 2010, Mehran and Thakor, 2011). A reduction in performance due to loan losses will, in turn, cause a decrease in the loanable amount available to an MFI and curtail its activities (Osborne et al., 2012; Tchakoute-Tchuigoua, 2016). Mehran and Thakor, (2011) suggest that expected and unexpected loan losses increase the probability of bankruptcy and insolvency for financial institutions. However, with buffer capital an MFI will be able to continue its operations in the presence of loan losses, thereby not forgoing current and future income. Consequently, the holding of buffer capital for the sake of loan losses should result in higher MFI performance.

A deterioration in loan portfolio quality may cause a reduction in the capital levels of MFIs because loan losses will eventually lead to the depletion of capital. Thus, loan losses harm valuable capital (Floro, 2010), increases the probability of capital falling below capital adequacy threshold and make MFIs susceptible to regulatory penalties and sanctions (Schaeck and Cihak, 2012). To avoid such regulatory penalties, MFIs may have to raise emergency capital. This emergency capital can be particularly expensive in unfavourable market conditions (Osborne et al., 2012). Nevertheless, Gambacorta and Mistrulli, (2004) suggest that MFIs that hold capital in excess of the minimum required may be able to absorb output shocks relative to less capitalised MFIs. Therefore, with output shocks caused by a deteriorating loan portfolio quality, buffer capital may increase performance by helping an MFI avoid the

payment of these penalties (Benes and Kumhof, 2015). Buffer capital is, therefore, expected to impact positively on the performance of MFIs in the presence of loan losses because it obviates the need to raise emergency capital and makes MFIs resilient to shocks to operating performance (Boyd and De Nocolo, 2005; Marinez-Miera and Repullo, 2010). Based on these considerations, we hypothesise that:

H2. Loan portfolio quality positively moderates the buffer capital-MFI performance relationship.

4. Methodology

4.1. Data Source and Sample Selection

We use data from the MIX market database; a web-based microfinance platform that provides data on MFIs across several countries. Generally, most studies on MFIs use data from MIX market database (see, Hudon and Traca, 2011; Mersland et al., 2011; Galema et al., 2012; Tchakoute-Tchuigoua, 2014; Tchakoute-Tchuigoua, 2016). A major advantage of the MIX market database is its worldwide coverage (Bogan, 2012). However, the MIX market database provides self-reported data which could give rise to data reliability issues. For example, not all MFIs may provide audited information. The diamond star is a classification based on the extent to which a particular MFI's reports and financial statements are certified, audited, or rated by reputable rating agencies (see, Quayes, 2012; Assefa et al., 2013; Louis and Baesens, 2013). The diamond star depicts the degree of transparency and reliability of MFIs' information. These diamond star categories range from 1 to 5, where 5 indicates the highest level of reliable MFI information (Assefa et al., 2013). As a result, many studies (Quayes, 2012; Assefa et al., 2013; Louis and Baesens, 2013; Tchakoute-Tchuigoua, 2016) have restricted their sample to MFIs with diamond star 4 and above because such MFIs have more reliable financial information. We, therefore, follow previous studies and restrict our sample to firms with

diamond star 4 and 5. Therefore, the sample consists of 625 MFIs and 1,708 firm-year observations for the period from 2010 to 2015 across 40 countries.

The sample involves MFIs from six regions as defined by the MIX market database including Africa, East Asia and the Pacific, Eastern Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, as well as South Asia. The country-specific information is sourced from the World Bank's World Development Indicators (WDI).

4.2. Variables

4.2.1. The dependent variable

We measure MFI performance in two ways: return on assets (ROA) and operational self-sufficiency (OSS). ROA has been used extensively as a measure of performance in MFIs (see, Assefa et al., 2013; D'espallier et al., 2017). The ROA is defined as the ratio of operating profit scaled by total assets. Further, operating self-sufficiency (OSS) is an important measure of performance in MFIs (see, Assefa et al., 2013; Tchakoute-Tchuigoua, 2014; Tchakoute-Tchuigoua, 2016). The OSS is defined as the ratio of financial revenue scaled by financial expenses plus net impairment loss and operating expense. It measures how far an MFI has come in covering its operating expenses with its operating income (Hartarska, 2005; Cull et al., 2007). The OSS is commonly used by donors and MFI management to assess performance (Rosenberg, 2009).

4.2.2 Independent variables

Our main variable of interest is buffer capital. We follow Valencia and Bolanos (2018) and measure buffer capital as the difference between an MFI optimal capital ratio and the minimum capital requirement¹. The country level minimum capital adequacy ratio is obtained from

¹ We use the terms minimum capital requirement and minimum capital adequacy ratio interchangeably.

different sources (see, Appendix 1), which remained constant throughout the sample period. The optimal capital ratio is not observable and, therefore, we follow previous studies in the financial literature (Jokipii and Milne, 2008; Valencia and Bolanos 2018) and predict it using MFI-specific and country level determinants. In all nine, MFI-specific variables are employed. These include: Return on capital employed (ROCE), which is measured as the ratio of profit for the year to equity plus total liabilities; Size, which is defined as the natural logarithm of the book value of total assets; Top quartile biggest MFIs (SizeCo), which is a dummy variable that takes one if the MFI size belongs to the top quartile in the sample and zero otherwise; Loan loss to the gross loan (LLGL), which measures the ratio of non-performing loans to gross loan portfolio; Cost of funding (CF), measured as the ratio of interest expenses on borrowings; Profit status, which is a dummy variable equals to one for profit-making MFIs and zero otherwise; Outreach, which is a dummy variable equals to one for large outreach MFIs, two for medium outreach MFIs and three for small outreach MFIs; Regulation, which is a dummy variable equal to one if an MFI is regulated and zero otherwise; and, finally, Target market, which is a dummy indicator for the four target markets classified as broad (1), high-end (2), low-end (3) and small business (4).

At the country level, we include the following variables: Gross domestic product growth (GDP growth), defined as the annual growth rate of the GDP per capita of a country; Inflation as a percentage of GDP (Inflation/GDP); Domestic credit to the financial sector as a percentage of GDP (Financial sector development); Rule of law, which assesses the law and order tradition of countries; Political stability, measuring the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means; and, Lerner index (Lerner), which measures the competitiveness of the MFI market. We follow Tchakoute-Tchuigoua, (2016) and compute the Lerner index as:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (1)$$

Where: P = the price of output, measured by the real gross portfolio yield (Cull et al., 2007).

MC is the marginal cost derived from the following translog cost function:

$$\begin{aligned} \ln C_{i,t} = & \beta_0 + \frac{1}{2} (\ln y)_{it}^2 + \sum y_{kt} \ln w_{k,it} + \sum \phi_k \ln y_{it} \ln w_{k,it} + \frac{1}{2} \sum \sum \beta_{kj} \ln w_{k,it} + \\ & \delta_1 (\text{Trend}) + \frac{1}{2} \delta_2 \text{Trend}^2 + \delta_3 \ln y_{it} (\text{Trend}) + \sum \phi_k \ln w_{k,it} (\text{Trend}) + \theta_t \ln (\text{size}) + \\ & \theta_2 \text{Par30} + V_{it} - su_{it} \end{aligned} \quad (2)$$

Where:

C_{it} = the total cost for an MFI i at the year t , calculated as financial expenses plus operating expenses. y_{it} = a proxy for output for an MFI i at the year t , defined as the gross loan portfolio. $w_{k,it}$ = the three input prices respectively: labour (w_1 : personal expenses scaled by number of employees), financial capital (w_2 : financial expenses scaled by total liabilities), and physical capital [w_3 : (operating expenses minus personnel expenses) scaled by total assets]. Trend = natural logarithm of the book value of total assets. Par30 = loan portfolio quality. Size = the total asset in US dollars. v_{it} = the idiosyncratic error. su_{it} = time-varying the panel-level effect.

The optimal capital ratio is derived from the residuals of the following regression:

$$ACR_{i,t} = \beta_0 + \sum_{i=9}^n \beta_1 MFI_{i,t} + \sum_{i=6}^n \beta_2 CV_{jt} + \varepsilon_{i,t} \quad (3)$$

Where:

ACR = Actual capital ratio, which is calculated as the ratio of total equity to total assets (see, Tchakoute-Tchuigoua, 2014; Tchakoute-Tchuigoua, 2016). MFI = MFI specific variables (ROCE, Size, SizeCo, LLRGL, CF, Profit, Outreach, Regulated, Target). CV_{jt} = country-specific variables (GDP growth, Inflation/GDP, financial sector development, rule of law, political stability, Lerner index).

Thus, following the approach of Valencia and Bolanos (2018), buffer capital is measured as the excess of the optimal capital ratio required by an MFI over the minimum capital adequacy ratio of the country of operation. In this case, a positive (negative) buffer

capital indicates that a particular MFI is holding more (less) capital than required. Buffer capital is derived as follows:

$$\text{Optimal capital ratio}_{it} - \text{minimum capital adequacy ratio}_{it} \quad (4)$$

4.2.3 Econometric model

To answer the question of whether buffer capital is value enhancing for MFIs, we use the panel data approach and control for MFI level variables as well as country-specific variables. In order to choose between fixed effect and random effect models, a Hausman's test is carried out to determine whether the unobserved heterogeneity (μ_i) of each firm and the explanatory variables are correlated. The null hypothesis was rejected by the Hausman's test, which indicates that the unobserved heterogeneity and the regressors are uncorrelated. This suggests that the fixed effects estimator is the more consistent and efficient method to use. Consequently, the fixed effect specification is preferred. We also control for year effects in all our regressions.

In line with previous studies (Godquin, 2004; Schaeck and Cihak, 2012; Assefa et al., 2013; Tchakoute-Tchuigoua, 2016), we first include MFI-specific variables that are known in the literature to affect performance. Loan portfolio quality may reduce performance because it increases MFIs' riskiness (Mehran and Thakhor, 2011). We, therefore, include loan portfolio quality in all the regressions. Studies have shown that the number of years of existence affect firm performance (Loderer and Waelchli 2010). For example, it may take time for younger MFIs to improve performance by building a clientele base. We, therefore, control for MFI age. In terms of age, Mix Market classify MFIs into three different categories: new, young, and mature. Therefore, our measure for Age consists of three different dummy variables for each of these categories. Further, an MFI's performance may be affected by outstanding loan portfolio through interest income. We, therefore, control for the level of the outstanding loan. Also, we control for size because MFI size is a determinant of performance due to the

economies of scale that larger firms enjoy (Serrasqueiro and Nunes, 2008). According to the agency theory, a large board size may impair meaningful board discussion and, therefore, affect overall MFI performance. We, therefore, control for the number of board of directors (Board size). Many recent studies have advocated for the presence of women on boards because they help improve performance (Mersland and Strøm, 2009; Gyapong et al., 2016). Therefore, the ratio of women directors (Female), measured as the ratio of women directors to board size is included. Leverage, measured as the ratio of liabilities to total assets is also controlled for. We also include the total expenses to total assets (Expense/Assets) because efficiency through expenses reduction is likely to lead to higher MFI performance. We control for the scale of operation, which refers to the scale of financial products and services provided to the poor by MFI groups. MFIs are grouped into small, medium and large scale of operations. Other control variables included are outreach, profit status, regulation, and target market, which have been defined in section 4.2.2 above.

Our second set of control variables relates to country-wide data. The overall growth of the economy has an impact on MFI performance, we, therefore, include GDP growth. The loss of the purchasing power of money could affect MFIs' performance. This is because inflation reduces the value of money. Inflation as a percentage of GDP growth is therefore included in the regressions. Further, since MFIs belong to the financial sector, their performance is affected by the level of financial sector development in the country of operation. We, therefore, control for financial sector development. Also, MFIs' performance may improve due to the strength of the rule of law. This is because MFIs operating in environments with strong rule of law have fewer loan losses (Tchakoute-Tchuigoua, 2014). Rule of law is therefore included as a control variable. Finally, we include political stability because businesses thrive under stable political environment (Julio and Yook, 2012).

To test our hypotheses, a fixed effects model is employed in the form:

$$y_{it} = \beta_0 + \beta_1 BC_{it} + \sum_{i=1}^n \beta_2 MFI_{i,t} + \sum_{j=5}^n \beta_3 CV_{j,t} + \varepsilon_{it} \quad (5)$$

Where:

y_{it} = ROA or OSS for MFI i at year t . BC_{it} = buffer capital for MFI i at year t . MFI_{it} = MFI-specific variables including, loan portfolio quality, outstanding loan portfolio, size, expenses/assets, leverage, age, outreach, profit status, regulation, target market, scale of operation, board size, female for MFI i at year t . CV_{jt} = country specific variables including, GDP growth, inflation/GDP, financial sector development, rule of law, political stability for country j at year t . e_i = the idiosyncratic error. All variables are as defined in Table 1.

[INSERT TABLE 1]

5. Empirical analyses

5.1 Summary statistics

Table 2 provides summary statistics for all the variables used in the regressions. All continuous variables are winsorised at the top 0.5% and the bottom 0.5% to reduce the problem of outliers. The mean value of the ROA is 0.0286 which shows that on average the sampled MFIs are barely profitable. The ROA of 2.86% is close to that reported by Mersland and Strøm (2009). The mean value of the OSS is 1.2384 which shows that on average the sampled MFIs have financial revenues that are higher than their total expenses. Buffer capital has a mean of 0.2358, which indicates that the average MFI in our sample is operating with a capital ratio well above the minimum capital adequacy ratio. This is similar to the 21% reported by Tchakoute-Tchuigoua (2016) and approximates to US\$196,893 worth of assets for the average MFI in our sample. Also, MFIs in the sample have approximately 8.71% of their loan portfolio at risk less than 30 days. This percentage is similar to the 7.1% reported by Mersland and Strom (2009). Further, size has a mean of US\$83.5 million and a median of US\$14.3 million. This is far below that of traditional banks in North Africa (\$37.48 billion), Central Africa (\$56.16 billion) and

Southern Africa (\$29.71 billion) (see, Sissy et al., 2017). This shows that MFIs are smaller in size compared to traditional banks. In terms of the corporate governance structure, the average MFI in our sample has a board size of 9.3835 and percentage of female directors of 29.54%, similar to the figures reported by Mersland and Strom (2009) as 7.391 and 23.5% for board size and percentage of female directors, respectively.

Regarding the country-specific variables, the average financial sector development for countries included in this study is 0.3973. This indicates that the level of financial sector development of countries under consideration is 39.73%. This is below that of other developed countries like France (84%), UK (116%) or US (184%) (See, Beck et al., 2008) and implies that MFIs are mainly found in developing countries with relatively undeveloped financial sector.

[INSERT TABLE 2]

Table 3 presents country averages for minimum capital adequacy ratio, optimal capital ratio, buffer capital, ROA and OSS; number of MFIs and year-observations. The country with the highest level of minimum capital adequacy ratio is Uganda with 20%; while the country with the lowest actual capital is Swaziland with 8%. The two countries with the highest and lowest optimal capital are Georgia (42.61%) and Kosovo (25.31%), respectively. The results show that the most profitable (least profitable) MFIs are in Vietnam (Bulgaria) with an average ROA of 5.32 % (0.094%). In terms of OSS, the country with the highest (lowest) value is Benin (Haiti) with an average OSS of 1.5064 (1.1166). The last two columns show wide variations in terms of the number of MFIs and their year observations across different countries represented in the sample.

[INSERT TABLE 3]

Pearson's bivariate correlation matrix of the dependent and independent variables are presented in Table 4. Liu et al. (2014) noted that a correlation greater than or equal to 0.7 is an indication

of multicollinearity. However, the results in Table 4 indicate that correlations between the independent variables are generally low, with no correlation greater than or equal to 0.5. We also check for multicollinearity by using the variance inflation factor (VIF). The mean VIF value is 1.40, and ranges from 1.05 to 2.18. The range of the VIF falls far below the conventional threshold of 10 (Gujarati, 2009). Therefore, multicollinearity is not a serious issue for our estimates.

[INSERT TABLE 4]

5.2 Main results

Table 5 presents the regression results. Consistent with Petersen (2009), we account for heteroscedasticity by clustering the standard errors at the MFI-level.

5.2.1 Buffer capital and MFIs' performance

As shown in the descriptive statistics (Table 2), most MFIs keep buffer capital despite their limited access to debt capital and difficulties in accessing other forms of funds. We examine the value relevance of buffer capital in MFIs. Specifically, we investigate the effect of buffer capital on MFI performance (*ROA*). The results are shown in Table 5 (column 1). It indicates that buffer capital has a negative relationship with MFIs' performance (Buffer capital = -0.1015 ; t -statistics = -4.54) and the relationship is statistically significant at the 1% level. This finding supports H1 and indicates that buffer capital reduces the performance of MFIs. Specifically, the findings show that a 10% increase in buffer capital is associated with approximately 1.015% reduction in ROA. This is consistent with the results when using the OSS as a measure of performance. As shown in Table 5, columns (3). Column (3) shows that buffer capital still impacts negatively on MFI performance using OSS (Buffer capital = -0.5394 , t -statistics = -4.05)

These results indicate that *ceteres paribus*, MFIs with capital in excess of the minimum capital adequacy have lower performance. The trade-off theory suggests that optimal capital should enhance performance because it trades off benefits and costs (Berger et al., 1995; Osborne et al., 2012). Therefore, the negative association between buffer capital and MFIs' performance may be because the holding of buffer capital distorts optimality and reduces performance. Further, Mia and Lee (2017) documented that funders influence MFIs so that one of either their profitability or social objectives overshadow the other. Nonetheless, Tchakoute-Tchuigoua (2016) suggests that most MFIs rely on subsidies and grants for funding. There is also evidence that a focus on social objectives reduces profitability (Lopatta et al., 2017). Therefore, the negative buffer capital-performance relationship may also be attributed to the fact that MFIs rely on providers of grants and subsidies, and these funders influence them to focus more on their social objections leading to a decline in performance.

5.2.2 Buffer capital, loan portfolio quality and MFIs' performance

To test the effect of loan portfolio quality on the relationship between buffer capital and MFIs' profitability, we re-estimate equation (5) and moderate buffer capital with loan portfolio quality. The regression results as reported in Table 5 column (2) show that the buffer capital-loan portfolio quality interaction has a positive and statistically significant relationship with ROA (Buffer capital*Par30 = 0.6652, *t*-statistics = 4.54). Similarly, results in column (4) indicate that when using OSS as a performance measure the buffer capital-loan portfolio quality interaction has a positive and statistically significant relationship with MFI performance (Buffer capital*Par30 = 1.7591, *t*-statistics = 2.20).

This is consistent with H2 and indicates that loan portfolio quality positively moderates the buffer capital-MFI performance relationship. This implies that MFIs with poor loan portfolio quality can improve performance by keeping buffer capital. Poor loan portfolio

quality increases MFIs' riskiness by exposing them to insolvency (Mehran and Thakhor, 2011). Additionally, poor loan quality can reduce capital levels and impinge on the ability of MFIs to lend, thereby reducing performance. However, compared to traditional banks, MFIs are particularly prone to poor loan portfolio quality. This is because MFIs mainly serve informationally opaque customers (Tchakoute-Tchuigoua, 2016). The results are, therefore, in consonance with the argument that poor loan portfolio quality causes MFIs to hold higher buffer capital (Tchakoute-Tchuigoua, 2016). The findings support Boyd and De Nocolo (2005) and Marinez-Miera and Repullo (2010) who noted the need for higher capital levels in times of poor loan portfolio quality.

[INSERT TABLE 5]

6. Robustness Tests

6.1 Deposit-taking MFIs

MFIs mainly rely on owners' equity, donations, and grants because they mostly have no access to debt markets (Dorfleitner et al., 2016) and only a few take deposits (Bogan, 2012). In fact, the Basel Committee on Banking Supervision (2010) states that only 5% of MFIs take deposits. Nevertheless, deposits are cheaper than external funds (Berger et al., 1995; Gorton and Winton, 2003) because external funds attract higher expected return (Allen et al., 2011). Impliedly, buffer capital is likely to be more expensive for non-deposit taking MFIs because they lack access to customer deposits which may be cheaper than the other available sources of funding. Consequently, it could be the case that the negative buffer capital-performance relationship is driven by non-deposit taking MFIs in our sample. We, therefore, investigate whether the buffer capital-MFI performance relationship is different for deposit-taking MFIs. To achieve this, we separate our sample into deposit and non-deposit taking and only concentrate on deposit-taking MFIs.

The results are reported in Table 6 (columns 1 and 2). In column (1), the results indicate that the relationship between buffer capital and the performance of deposit-taking MFIs is negative despite having access to clients' deposits (Buffer capital = -0.0737 , t -statistics = -1.97). In terms of how loan portfolio quality moderates the buffer capital-performance relationship, the results in column (2) show that deposit-taking MFIs that hold buffer capital in the presence of poor loan portfolio quality enjoy higher performance (Buffer capital*part30 = 0.5234 , t -statistics = 2.06). These indicate that our results are not driven by non-deposit taking MFIs.

6.2 Profit-making MFIs

Some MFIs operate as for-profit organisations; however, the majority of MFIs are operating as not-for-profit organisations (Hartarska et al., 2013). One argument expounded in the literature as a way for MFIs to become operationally self-sufficient is through commercialisation (Armendáriz de Aghion & Morduch, 2000; Battilana & Dorado, 2010); from not-for-profit to for-profit. Commercialisation can help MFIs to attract different sources of funds including commercial debt. Achieving profit status may increase an MFI's access to capital because it will help attract profit-maximizing investors (Cull et al., 2009). With the increased access to other sources of funds (commercial capital) relative to non-profit MFIs, for-profit MFIs may be able to avoid other expensive sources of capital with stringent conditionalities that may require them to pursue value-decreasing social missions (Downey and Conroy, 2010; Mia and Lee, 2016). Thus, if buffer capital is more expensive for not-for-profit MFIs, then not-for-profit MFIs could be driving the buffer capital MFI-performance relationship.

We examine whether our results hold for-profit MFIs. To do that, we segregate our sample into for-profit and not-for-profit samples and focus only on the former. The results which are presented in Table 6, column (3), show that buffer capital is negatively associated

with the performance of for-profit MFIs (Buffer capital = -0.0850 , t -statistics = -2.77). Moreover, the interaction of buffer and loan portfolio quality in column (4) show a positive and statistically significant association (Buffer capital*part30 = 0.8632 , t -statistics = 4.63). These results indicate that the main results reported in Table 5 do not differ for for-profit MFIs.

6.3 Regulated MFIs

The regulation of MFIs has become increasingly popular in most developing countries for two reasons. First, donors and government agencies believe that the regulation of MFIs can help bring sustainability into their operations. Second, many MFIs are seeking transformation into regulated institutions in order to be able to access cheaper sources of finance including local currency deposits. In fact, Hartarska and Nadolnyak, (2007) suggest that there may be indirect benefits to regulation through access to clients' savings. This may reduce the cost of capital for regulated MFIs and make buffer capital less expensive. Thus, we examine the robustness of our results to the proposition that the negative effect of buffer capital and MFI performance may be driven by non-regulated MFIs. To achieve this, we run regressions for only regulated MFIs and report the results in Table 6, columns (5 and 6).

The results in column (5) show that buffer capital on its own has a negative relationship with regulated MFIs' performance (Buffer capital = -0.0970 , t -statistics = -3.42). However, the interaction of buffer capital and loan portfolio quality leads to a positive relationship (Buffer capital*part30 = 0.5970 , t -statistics = 3.12). Overall, the results are qualitatively similar to our earlier findings.

[INSERT TABLE 6]

6.4 Alternative Measure of Firm Performance – efficiency

Previous studies have also used efficiency measures to examine MFIs' performance (Hermes et al., 2011; Bos and Millone, 2015). This is important because efficiency is expected to lead to higher performance (Baik et al., 2013). Therefore, as a way of robustness, we also present

the results of the effect of buffer capital on MFIs' efficiency in columns (1 and 2) of Table 7, using the stochastic frontier analysis (SFA) approach. We follow the procedure adopted by Hermes et al. (2011) and estimate the cost function. The cost function is used to measure the cost of MFI operations to the cost of the best MFI if the two MFIs produced identical output under similar conditions (Hermes et al., 2011). We specify the cost function as:

$$\ln(TC_{it}) = \beta_0 + \beta_1 \ln(Salary_{it}) + \beta_2 \ln(R_{it}) + \beta_3 \ln(GLP_{it}) + \beta_4 Salary_{it}^2 + \beta_5 \ln(R_{it}^2) + \beta_6 \ln(GLP_{it}^2) + \beta_7 \ln(Salary_{it}) \ln(R_{it}) + \beta_8 \ln(Salary_{it}) \ln(GLP_{it}) + \beta_9 \ln(R_{it}) \ln(GLP_{it}) + \sum_{j=i}^4 \beta_{10} MFIType_{ij} + \beta_{11} LLR_{it} + \mu_{it} + V_{it} \quad (6)$$

Where: TC = total costs of an MFI measured as the ratio of total expenses to total assets multiplied by total assets. $Salary$ = the price of one factor of labour for one year, measured as the operating expenses to total assets ratio times total assets in US dollars. R = the interest expenses of holding money measured as the financial expenses to total assets ratio divided by the total deposits to total assets². GLP = the gross loan portfolio. $MFIType$ = a dummy variable equals to 1 if an MFI is a bank, 2 if an MFI is a cooperative, 3 if an MFI is a non-bank financial institution and 4 if an MFI is a non-governmental organisation. Loan loss reserves, which measures the risk-taking strategies among MFIs. To examine the effect of buffer capital on MFIs' efficiency, we re-specify equation (5) and replace ROA with the efficiency measure.

As anticipated, the results in column (1) show that buffer capital negatively impacts on MFIs' efficiency (Buffer = -1.5615, t -statistics = -5.16). Specifically, a 10% increase in buffer capital leads to a 15.615% decrease in efficiency. Thus, MFIs that hold capital ratios above the optimal are less efficient. The results in column (2) show that the interaction of buffer capital-loan portfolio quality is positive and statistically significant at the 5% (Buffer*Par30 = 3.9657, t -statistics = 2.17), suggesting that in the presence of poor loan portfolio quality the holding of buffer capital enhance MFIs' efficiency.

² This measure is excluded for non-deposit MFIs.

6.5 Alternative Measure of Buffer Capital – actual capital ratio minus minimum capital requirement (buffer capital 1)

Following Tchakoute-Tchuigoua (2016), we test the sensitivity of our results to an alternative measure of buffer capital (buffer capital (1) as the difference between MFIs' actual capital ratio and country minimum capital requirement. The results are presented in Table 7, columns (3 and 4). Column (3) shows that buffer capital (1) has a negative relationship with MFI performance and the relationship is statistically significant (Buffer capital (1) = -0.0938 , t-statistics = -40.30). The results for the effect of the buffer capital (1)-loan portfolio quality interaction on MFI performance is also presented in column (4). It shows that the interaction of capital ratio (1) and loan portfolio quality impacts positively on MFI performance (Buffer capital (1) *par30 = 0.3685 , t-statistics = 4.25). These indicate the robustness of our results to an alternative measure of buffer capital.

6.6 Alternative Measure of poor loan quality – gross loan portfolio growth

We also test the sensitivity of our main results to a change in measurement of the loan portfolio quality. More specifically, we replace the loan portfolio quality with the change in gross loan portfolio growth. The loan portfolio quality is an ex-post measure of portfolio risk; whereas the gross loan portfolio growth is an ex-ante measure of portfolio risk. We, therefore, examine the moderating effect of an ex-ante measure of portfolio risk to the relationship between buffer capital and MFI performance. The fact that gross loan portfolio represents the amount clients owe means an increase may lead to a higher risk of non-payment.

The results are presented in Table 7, columns (5 and 6). Column (5) presents the result for the effect of buffer capital on the performance of MFIs after controlling for changes in gross loan portfolio growth. The results for the effect of the buffer capital and changes in gross loan

portfolio growth interaction on MFIs' performance are also presented in column (6). The results confirm that the relationship between buffer capital and MFI performance remains negative and statistically significant. Also, changes in gross loan portfolio growth positively moderate the effect of buffer capital on MFIs' performance. This shows that our results are robust to an alternative measure of loan portfolio quality.

[INSERT TABLE 7]

6.7 Endogeneity

Generally, endogeneity may arise from three sources: omitted variable bias, a correlation between the error term and a regressor, and simultaneity (Wooldridge, 2002; Larcker and Rasticus, 2010; Ntim et al., 2012). With respect to this study, omitted variable endogeneity may arise if a relevant control variable is omitted due to data unavailability (Wooldridge, 2002; Ntim et al., 2012). In addition, our fixed effects estimates may be biased and inconsistent if buffer capital is not exogenous but rather correlated with the error term. Further, simultaneity arises when the independent variable – buffer capital is simultaneously determined by the dependent variable – ROA or OSS. For example, Berger and Patti (2006) suggest that lower equity capital ratio is associated with higher performance in financial firms. However, MFIs lack debt funding, therefore, keeping buffer capital may result in high equity ratios (Garmaise and Natividad, 2013). Consequently, although we have assumed that buffer capital reduces MFI performance, it could be the case that high MFI performance simultaneously reduces the need to keep buffer capital. This is because high-performing MFIs may have a lower cost of capital and may keep less buffer capital because of their ability to raise capital at a lower cost when required. We, therefore, address endogeneity in two ways: First, we use the two-stage least squares (2SLS) approach. Second, we adopt the Hausman-Taylor estimation.

6.8 Two-Stage Least Squares (2SLS) Estimation

Adams and Ferreira (2009) recommend a 2SLS in dealing with simultaneity and other forms of endogeneity. We, therefore, employ a 2SLS estimation to address the problem of endogeneity. We first attempt to identify an instrument for the 2SLS regression. A suitable instrument should have a significant correlation with the main independent variable (*Buffer capital*) and insignificant or no correlation with the dependent variable (*ROA*).

Compared to lenders, borrowers are better informed on their willingness and capacity to repay their loans (Tchakoute-Tchuigoua, 2016). In the case of MFIs, the information asymmetry is likely to be higher because they mainly focus on clients that lack reliable financial information and collateral (Stiglitz, 1990). This increases the risk inherent in their loan portfolio necessitating higher capital ratios. Existing studies (Kearney et al., 2012; Faccio et al., 2016) suggest that decisions regarding the capital of financial institutions are strongly influenced by cultural factors. For example, people in high uncertainty avoidance cultures are more likely to take actions aimed at reducing the level of uncertainty (Hofstede, 2001). Accordingly, Chen et al. (2015) report that corporate cash holdings are higher in firms in high uncertainty avoidance countries. Their result is consistent with Li et al. (2013) who report that the higher levels of risk aversion in high uncertainty avoidance countries motivate them to hold more cash in anticipation of declining future cash flows. We argue that *ceteres paribus* MFIs in high uncertainty avoidance countries will keep buffer capital in anticipation of poor loan quality. We, therefore, employ uncertainty avoidance as measured by Hofstede (1980) as an instrument for buffer capital in addition to the control variables mentioned above. To justify the use of 2SLS estimation to control for endogeneity, we employ the Durbin-Wu-Hausman (DHW) test. The result, which is displayed in column (2) of Table 8, shows the presence of endogeneity and therefore warrant our use of 2SLS to control for endogeneity.

We note that uncertainty avoidance has a high and statistically significant correlation with buffer capital and a conventionally low and statistically insignificant correlation with our measure of MFI performance (not reported). We run the 2SLS using uncertainty avoidance as an instrument for buffer capital. In the first stage (column 1 of Table 8), we replace buffer capital with uncertainty avoidance and make buffer capital the dependent variable in equation (5). We then predict the value for buffer capital (*buffer capital*[^]) and use it as the main independent variable in equation (5). The results of the second stage of the 2SLS are shown in Table 8, column (2). The results indicate that buffer capital impacts negatively on ROA (buffer capital[^] = -1.2404, t-statistics = -2.88). The results imply that buffer capital is still value decreasing in MFIs even after controlling for endogeneity.

6.9 The Hausman-Taylor Estimation

We based our analysis on the fixed effects regressions because results from the Hausman tests suggest that the fixed effects estimates are more consistent. However, Mundlak (1978) argues that the fixed effects model assumes endogeneity for all the regressors whilst the random effects model assumes exogeneity for all the regressors. “This all or nothing choice of correlation” can be problematic in models containing both endogenous and exogenous regressors (Baltagi et al., 2003, p. 261). In the current study, buffer capital may be endogenously determined (where high performing MFIs may choose to reduce costs by keeping lower buffer capital), but the inflation rate may be an exogenous variable.

Oh et al. (2016) suggest the Hausman-Taylor estimation as an improvement over the fixed and random effects models. The Hausman-Taylor model allows for the estimation of time-invariant regressors (Greene, 2003), and uses both the within-variation and between the variation of the exogenous variables as instruments to address the endogeneity problem

(Baltagi et al., 2003; Oh et al., 2016). Consequently, we re-estimate the buffer capital-MFI performance relationship using the Hausman-Taylor estimation.

The results as shown in Table 8, columns (3 and 4) are consistent with the fixed effects estimates. The coefficient estimation of buffer capital is (-0.0991 , t -statistics = -5.25) in column (3) whereas the interaction of buffer capital and loan portfolio quality is (0.8400 , t -statistics = 3.57) in column (4). The results indicate that buffer capital remains value decreasing in MFIs even after accounting separately for exogenous time-varying and time-invariant regressors, as well as endogenous time-varying regressors. However, buffer capital becomes value enhancing with poor loan portfolio quality.

6.10 Survivorship bias

Generally, survivorship bias arises when firms are excluded from the study sample for lack of complete data (Kestens et al., 2012). This is particularly critical in value relevance studies because poor performance is a major reason why firms disappear (Carvalho and Nobili, 2011). Goto et al. (2015) suggest that survivorship bias may be reduced by including all firms within the sample periods. Consequently, we did not exclude MFIs without complete data from our sample. Nevertheless, this can potentially result in an instance where the results are driven by firms with full data during the sample period. Therefore, following Schaeck and Cihak (2012), we investigate survivorship bias by restricting our sample to MFIs that did not have complete data during the sample period.

The results are presented in Table 8, columns (5 and 6). Column (5) presents result for the effect of buffer capital on the performance of MFIs. The results for the effect of the buffer capital-loan portfolio quality interaction on MFIs' performance are also presented in column (6). The results confirm that the relationship between buffer capital and MFI performance remains negative and statistically significant (-0.0885 , t -statistics = -3.75). Also, loan portfolio

quality positively moderates the effect of buffer capital on MFIs' performance (0.6940, t-statistics = 4.34). This shows that our results are robust to survivorship bias.

[INSERT TABLE 8]

6.11 Oster test of endogeneity

The Oster (2019) test is used to measure the influence that unobserved time variant and time invariant omitted variables have on the reported results (Adams and Ferreira, 2009; Oster, 2019). This is important because the omission of certain control variables may invalidate the results of the main variables (Wang and Yin, 2018). The presence of omitted variables bias is determined by testing the stability of the coefficients of interest, based on two main assumptions: (1) unobserved time variant and time invariant omitted variables have the same importance as the observed time-variant and time-invariant variables included in the main regressions; (2) the R^2 from the main regressions can be improved by 1.3 times if the unobserved time variant and time invariant omitted variables are included in the main regressions. Thus, the Oster (2019) test is able to determine the extent to which the influence of the unobservables can cause the coefficient of the variables of interest to be redundant. This is a sensitivity-type test that measures the extent to which the inclusion of extra control variables will cause changes in the coefficient of the variables of interest and their R^2 .

We, therefore, follow the Oster (2019) test procedure as applied in other studies (Wang and Yin, 2018) to examine whether our main results reported in Table 5 suffer from omitted variables bias. The results are presented in Table 9. The columns in Table 9 presents information as follows: column (1) the coefficients of the variables of interest from Table 5; column (2) the 95% confidence intervals of the estimated coefficient of interest; column (3) the R^2 from the main regressions; column (4) the identified set of bounds of the coefficient for the controlled set (β) and the full set (including omitted variables); column (5) the movement

in the coefficients of interest; and column (6) whether the coefficients of interest are within the 95% confidence intervals. Overall, the results presented in Table 9 suggest that there is no omitted variables bias which is affecting the main results reported in Table 5. First, the results in column (5) indicate that the coefficients of the variables of interest all move away from zero, with the exception of Buffer*par30 in column (4). Second, the results contained in column (6) show that the coefficients of the variables of interest are all within the 95% intervals.

[INSERT TABLE 9]

7. Conclusion

We examine the value relevance of buffer capital in MFIs around the world. Specifically, we address the question of whether buffer capital affects the performance of MFIs and how loan portfolio quality may moderate this relationship. The findings suggest a negative and statistically significant relationship between buffer capital and MFI performance. Nevertheless, buffer capital is value-increasing in MFIs with poor loan portfolio quality. Following on from this, we further examined whether this relationship differs in deposit-taking, profit-making, and regulated MFIs. The results indicate that buffer capital has an effect on the performance of deposit-taking, profit-making, and regulated MFIs.

There have been recent debates about the rampant collapses of MFIs. This paper adds to this debate by providing evidence on the relationship between buffer capital and the performance of MFIs. The main lesson from our study for managers and regulators of MFIs is that for improved performance, the level of capital kept by MFIs should be dependent on loan portfolio quality. The findings will be useful to regulators and policy makers especially in developing countries where MFIs are prevalent.

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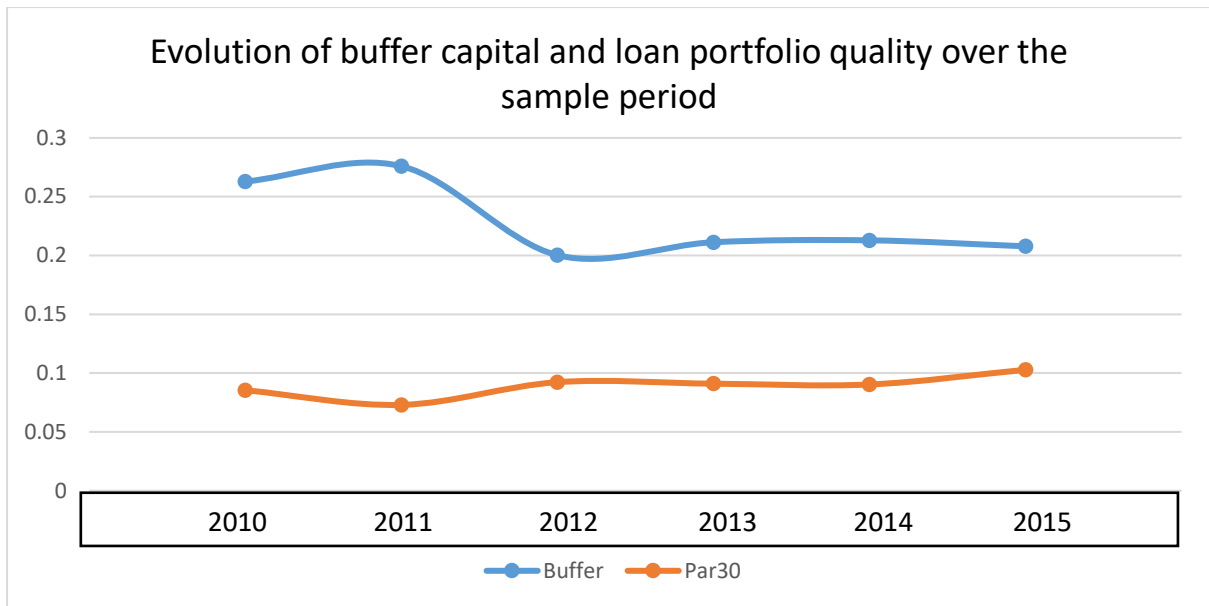


Figure 1: presents the evolution of buffer capital and loan portfolio quality over the period 2010–2015. Buffer capital and loan portfolio quality are in decimals.

Appendix 1

Country	Minimum capital adequacy ratio	Source
Afghanistan	12	http://documents.worldbank.org/curated/en/107861479819060658/pdf/1479819058868-0000A8056-ITM00184-P161348-11-22-2016-1479819056952.pdf
Argentina	11.5	http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/Caprio_2000_Argentina.xls
Armenia	10	https://www.adb.org/sites/default/files/publication/421641/adbi-wp843.pdf
Azerbaijan	10	http://documents.worldbank.org/curated/en/741611492752081369/pdf/114454-WP-CA-Microfinance-Policy-2010-PUBLIC.pdf
Bangladesh	10	https://www.bb.org.bd/fnansys/regulator.php
Benin	15	https://www.imf.org/external/pubs/ft/scr/2016/cr1607.pdf
Bolivia	10	https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Impact-of-the-New-Financial-Services-Law-in-Bolivia-on-Financial-Stability-and-Inclusion-43473
Bosnia and Herzegovina	12	http://documents.worldbank.org/curated/en/123181493604145783/pdf/Bosnia-Banking-PAD-04112017.pdf
Bulgaria	12	https://www.findegateway.org/sites/default/files/mfg-en-paper-bulgaria-regulation-no-8-on-the-capital-adequacy-of-banks-2002.pdf
Cambodia	15	https://www.nbc.org.kh/download_files/mr.nget-sovannarith-banking-supervision-02-october-2017-roundtable.pdf
Chile	10	https://www.bis.org/publ/bcbs167.pdf
Colombia	9	https://www.imf.org/external/pubs/ft/scr/2013/cr1350.pdf
Dominican Republic	10	http://documents.worldbank.org/curated/en/827421468182954473/pdf/96315-WP-P149283-Box391433B-PUBLIC-Jamaica-TN-SME-finance-COLL-TITLE-Financial-and-private-sector-development.pdf
Ecuador	9	https://gettingthedealthrough.com/area/4/jurisdiction/32/banking-regulation-ecuador/
Egypt	10	https://www.cbe.org.eg/_layouts/download.aspx?SourceUrl...2016.pdf
El Salvador	12	https://www.imf.org/external/pubs/ft/scr/2014/cr1444.pdf
Ethiopia	12	https://www.nbe.gov.et/pdf/directives/microfinancebusiness/img226.pdf
Georgia	12	https://www.imf.org/external/pubs/ft/scr/2014/cr14355.pdf
Ghana	10	https://www.bog.gov.gh/privatecontent/Banking_Supervision/Basel%20II%20-%20BOG%20CRD%20Final%2027%20June%202018%20%20Basel%20Committee%20BSD.pdf
Guatemala	10	https://webcache.googleusercontent.com/search?q=cache:qHTzvtw0IQJ:https://www.imf.org/~media/Files/Publications/CR/2018/cr18154-GuatemalaBundle.ashx+&cd=1&hl=en&ct=clnk&gl=uk
Haiti	12	https://www.imf.org/external/pubs/ft/scr/2008/cr08112.pdf
Honduras	10	https://www.imf.org/external/pubs/ft/scr/2016/cr16363.pdf
India	15	http://www.cuts-ccier.org/pdf/Regulation_of_Microfinance_Institutions_in_India.pdf
Jordan	12	http://www.cbj.gov.jo/EchoBusV3.0/SystemAssets/PDFs/EN/FINANCIAL%20STABILITY%20REPORT%202016.pdf
Kenya	12	https://www.centralbank.go.ke/uploads/banking_sector_annual_reports/873911276_2017%20Annual%20Report.pdf

Kosovo	12	https://bqk-kos.org/repository/docs/korniza_ligjore/english/1-Amended%20Regulation%20on%20Bank%20Capital%20Adequacy%20-%20ENG%20(1).pdf
Malawi	10	https://webcache.googleusercontent.com/search?q=cache:HzTh9WL5RhYJ:https://www.rbm.mw/Home/GetContentFile/%3FContentID%3D7800+&cd=6&hl=en&ct=clnk&gl=uk
Nigeria	10	https://www.cbn.gov.ng/out/2013/ccd/amended%20regulatory%20and%20supervisory%20guidelines%20for%20mfb.pdf
Pakistan	15	http://www.sbp.org.pk/about/micro/criteria.htm
Paraguay	10	http://enif.paraguay.gov.py/storage/app/uploads/public/59b/16a/bc9/59b16abc92fa3997350919.pdf
Peru	10	https://webcache.googleusercontent.com/search?q=cache:4akxs8xTM-8J:https://www.imf.org/~media/Files/Publications/CR/2018/cr18238-PeruFSSA.ashx+&cd=1&hl=en&ct=clnk&gl=uk
Philippines	10	http://www.bsp.gov.ph/regulations/implementation.asp
Rwanda	15	https://www.bnr.rw/fileadmin/AllDepartment/FinancialStability/BankingSupervision/Annual_Financial_Stability_Report_2015_2016_Final_approved_Stamped_.pdf
Swaziland	8	http://webcache.googleusercontent.com/search?q=cache:U_7TyrLWSNUJ:cfi.org.sz/index.php/publications%3Fdownload%3D4:state-of-the-microfinance-sector-in-swaziland-final-report-august-2016+&cd=2&hl=en&ct=clnk&gl=uk
Tajikistan	12	https://www.imf.org/external/pubs/ft/scr/2016/cr1641.pdf
Togo	12	https://www.reuters.com/article/tanzania-cenbank/update-1-tanzania-central-bank-announces-new-capital-rules-for-banks-idUSL8N1JA415
Tunisia	10	https://www.bct.gov.tn/bct/siteprod/documents/sup_bc_ang.pdf
Uganda	20	https://www.bou.or.ug/bou/media/from_the_bank/Minimum_Capital_Requirements_FIs_Supervised_by_BoU.html
Ukraine	10	https://bank.gov.ua/control/en/publish/article?art_id=88169512&cat_id=76291
Vietnam	10	http://www.microfinance.vn/category/microfinance-in-vietnam/page/2/

Table 1: Description of variables and data source

Variables	Description	Source
MFI variables		
Return on assets	The ratio of operating profit scaled by total assets	MIX Market
Efficiency	Estimated using the Stochastic Frontier Analysis	Own calculation
Operating self-sufficiency	Financial Revenue (Total)/ (Financial Expense + Loan Loss Provision Expense + Operating Expense).	MIX Market
Actual capital ratio	The ratio of total equity to total assets.	Own calculation
Optimal capital ratio	Predicted using MFI-specific and country level determinants.	Own calculation
Buffer capital	Measure of capital buffer in absolute terms, that is, the difference between an MFI optimal adequacy ratio and the country minimum capital adequacy requirement	MIX Market
Loan portfolio quality	The ratio of portfolio at risk > 30 days to gross loan	MIX Market
Size of loan portfolio	Outstanding loan portfolio/total assets	MIX Market
Size	Total assets in US dollars	MIX Market
Expenses to total assets	The ratio of total expenses to total assets	MIX Market
Leverage	The ratio of liabilities to total assets.	MIX Market
Age	Number of years functioning as an MFI	MIX Market
Outreach	A dummy variable equals to one for large outreach MFIs, two for medium outreach MFIs and three for small outreach MFIs.	MIX Market
Profit status	A dummy variable equals to one for profit-making MFIs and zero otherwise.	MIX Market
Regulation	A dummy variable equals to one if an MFI is subject to prudential rules and zero otherwise.	MIX Market
Target market	A dummy indicator for the four target markets classified as broad (1), high-end (2), low-end (3) and small business (4).	MIX Market
Scale of operation	Refers to the scale of financial products and services provided to the poor by MFI groups. MFIs are grouped into small, medium and large scale of operations	MIX Market
Lerner Index	Measures the competitiveness of the MFI market.	Own calculation
Deposit-taking	A dummy variable equals to one if an MFI accepts deposits and zero otherwise.	MIX Market
Return on capital employed	Measured as the ratio of profit for the year to equity plus total liabilities	MIX Market
Top quartile biggest MFI	A dummy variable that takes one if the MFI size belongs to the top quartile in the sample and zero otherwise	Own calculation from Mix Market data
Loan loss to gross loan (LLGL)	Measures the ratio of non-performing loans to gross loan portfolio	MIX Market

Cost of funding (CF)	The ratio of interest expenses on borrowings	MIX Market
Total cost	Calculated as financial expenses plus operating expenses	Own calculation from Mix Market data
Labour	w_1 : personal expenses scaled by number of employees), financial capital (w_2 : financial expenses scaled by total liabilities), and physical capital [w_3 : (operating expenses minus personnel expenses) scaled by total assets]	Own calculation from Mix Market data
Board size	The number of directors on the board of MFIs per annum.	MIX Market
Percentage of female directors	The ratio of women directors to board size.	MIX Market
Country variables		
GDP growth	The annual growth rate of the GDP per capita of a country.	WDI
Inflation/GDP	Inflation as a percentage of GDP	WDI
Financial sector development	Domestic credit by the financial sector. Includes all credit to various sectors. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available	WDI
Rule of law	Measures the law and order tradition of countries	WDI
Political stability	Measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means	WDI

Table 2. Summary statistics

Variable	N	mean	SD	P25	p50	p95
ROA	1708	0.0286	0.0238	0.0128	0.0178	0.0646
Operating self-sufficiency	1708	1.2384	0.1142	1.1881	1.2161	1.4164
Buffer capital	1708	0.2358	0.0503	0.2012	0.2321	0.3227
Optimal capital ratio	1708	0.3456	0.0489	0.3112	0.3412	0.4290
Loan portfolio quality	1708	0.0871	0.0501	0.0594	0.0619	0.1801
Minimum capital adequacy	1708	0.1098	0.0152	0.1000	0.1000	0.1200
Outstanding Loan Portfolio	1708	0.8161	0.2967	0.7323	0.8232	1.0077
Size (\$ Million)	1708	83.500	28800	4.6159	14.300	39400
Expenses/Assets	1708	0.2135	0.0706	0.1989	0.2058	0.2740
Leverage	1708	0.7231	0.2072	0.6237	0.8112	0.9384
Age	1708	2.7102	0.5887	3.0000	3.0000	3.0000
Outreach	1708	1.8806	0.9003	1.0000	2.0000	3.0000
Profit Status	1708	0.4251	0.4945	0.0000	0.0000	1.0000
Regulation	1708	0.5867	0.4926	0.0000	1.0000	1.0000
Target Market	1708	2.1897	1.0057	1.0000	3.0000	3.0000
Scale of operation	1708	1.9602	0.8445	1.0000	2.0000	3.0000
Board size	1708	9.3835	24.9840	5.0000	7.0000	15.0000
Female	1708	0.2954	0.2219	0.1500	0.2845	0.7300
GDP Growth	1708	0.0504	0.0228	0.0353	0.0495	0.0841
Inflation/GDP	1708	0.0663	0.0516	0.0358	0.0597	0.1526
Financial Sector Development	1708	0.3973	0.1730	0.2614	0.3980	0.6603
Rule of Law	1708	-0.5045	0.5128	-0.9293	-0.5508	0.5237
Political Stability	1708	-0.6310	0.7277	-1.1251	-0.6395	0.2671

This Table displays summary statistics for variables used in the regression tests. Definitions of the variables are provided in Table 1

Table 3. Sample description: mean by country

Country	Minimum capital requirement	Optimal Capital Ratio	Buffer capital	ROA	OSS	MFIs	MFI-Observations
Afghanistan	12	0.3532	0.2332	0.0279	1.2073	42	126
Argentina	11.5	0.3450	0.2300	0.0317	1.3133	9	27
Armenia	10	0.3847	0.2847	0.0150	1.2246	4	8
Azerbaijan	10	0.3572	0.2572	0.0215	1.2535	4	13
Bangladesh	10	0.3463	0.2463	0.0273	1.1466	28	69
Benin	15	0.3306	0.1806	0.0267	1.5064	14	13
Bolivia	10	0.4029	0.3029	0.0172	1.2174	3	9
Bosnia and Herzegovina	12	0.3651	0.2451	0.0284	1.2269	7	12
Bulgaria	12	0.4103	0.2903	0.0094	1.2148	4	6
Cambodia	15	0.3604	0.2104	0.0362	1.2283	1	2
Chile	10	0.3967	0.2967	0.0493	1.1874	5	11
Colombia	9	0.3224	0.2324	0.0295	1.1965	27	88
Dominican Republic	10	0.3512	0.2512	0.0262	1.3055	10	47
Ecuador	9	0.3449	0.2649	0.0216	1.2439	16	29
Egypt	10	0.3955	0.2955	0.0128	1.2336	8	21
El Salvador	12	0.3839	0.2639	0.0196	1.2666	15	43
Ethiopia	12	0.3708	0.2508	0.0140	1.2308	1	2
Georgia	12	0.4261	0.3061	0.0109	1.2336	1	3
Ghana	10	0.2962	0.1962	0.0289	1.2069	10	13
Guatemala	10	0.3724	0.2724	0.0291	1.2064	19	65
Haiti	12	0.3559	0.2359	0.0301	1.1166	21	45
Honduras	10	0.3368	0.2368	0.0232	1.2447	21	87
India	15	0.3373	0.2173	0.0335	1.2007	104	289
Jordan	12	0.3944	0.2744	0.0234	1.2150	8	21
Kenya	12	0.3340	0.2140	0.0191	1.2576	14	25
Kosovo	12	0.2531	0.1331	0.0133	1.2011	1	1
Malawi	10	0.2857	0.1857	0.0103	1.1934	1	3
Nigeria	10	0.2955	0.1955	0.0323	1.2041	7	13
Pakistan	15	0.3629	0.2129	0.0185	1.2498	24	41
Paraguay	10	0.3297	0.2297	0.0339	1.1828	51	223
Peru	10	0.3356	0.2356	0.0287	1.1697	37	87
Philippines	10	0.3498	0.2498	0.0254	1.2105	40	76
Rwanda	15	0.3628	0.2128	0.0242	1.2190	3	9
Swaziland	8	0.3650	0.2750	0.0273	1.2143	2	2
Tajikistan	12	0.3127	0.1927	0.0336	1.2178	11	41
Togo	12	0.3587	0.2387	0.0280	1.2485	23	61
Tunisia	10	0.3745	0.2745	0.0225	1.1984	13	46
Uganda	20	0.3331	0.1331	0.0180	1.2113	5	10
Ukraine	10	0.3098	0.2098	0.0141	1.2599	1	3
Vietnam	10	0.3571	0.2571	0.0532	1.3361	10	18

This Table reports, by countries, the means of minimum capital requirement, optimal capital ratio, buffer capital ratio, ROA and OSS; and number and observations of MFIs, respectively

Table 4. Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11
ROA	1										
Operating self-sufficiency	0.5391*	1									
Buffer capital	-0.1332*	-0.0248	1								
Loan portfolio quality	-0.2310*	-0.2275*	-0.3122*	1							
Outstanding Loan Portfolio	0.1723*	0.3443*	0.0332	-0.2698*	1						
Size (log) (\$ Million)	-0.0973*	-0.2905*	-0.2351*	-0.0246	0.0237	1					
Expenses/Assets	-0.1489*	-0.2254*	-0.0714*	0.2799*	0.0162	-0.0708*	1				
Leverage	0.1518*	0.0689*	-0.1451*	-0.0861*	0.1132*	0.2215*	-0.0287	1			
Age	-0.0222	-0.0822*	0.0355	0.0142	0.0054	0.2043*	-0.0685*	-0.0544*	1		
Outreach	0.0957*	0.1848*	-0.0417	0.0796*	-0.0517*	-0.4839*	0.0385	-0.1168*	-0.0432	1	
Profits Status	-0.0668*	-0.0455	-0.1658*	0.0407	0.0069	0.2586*	-0.0245	0.1026*	-0.2829*	-0.2478*	1
Regulation	0.0131	-0.0534*	-0.2997*	0.0121	0.0374	0.3755*	-0.0013	0.3575*	-0.1063*	-0.2118*	0.3057*
Target Market	-0.0169	0.1468*	0.2321*	-0.0705*	0.0619*	-0.1820*	0.0678*	-0.1055*	-0.1555*	-0.0947*	0.0981*
Scale of operation	0.0766*	0.1787*	0.0008	0.1485*	-0.0661*	-0.4993*	0.0338	-0.1364*	0.0015	0.3474*	-0.1362*
Board size	-0.0188	-0.0305	-0.0817*	0.0554*	-0.0373	0.1220*	-0.0083	0.0333	0.0454	0.001	-0.0602*
Female	0.2765*	0.1225*	0.0229	-0.0116	-0.0156	-0.1491*	-0.0058	-0.0706*	0.1357*	0.1159*	-0.1893*
GDP Growth	0.0786*	0.0619*	-0.1675*	0.0311	0.0129	0.0738*	-0.0827*	0.2098*	-0.1433*	-0.1252*	0.0676*
Inflation/GDP	0.0211	0.0692*	-0.0083	0.0161	-0.0188	-0.1496*	0.0125	0.0796*	-0.1288*	0.0326	0.0254
Financial Sector Development	0.0501*	0.1142*	0.0886*	-0.1121*	0.1748*	-0.0285	-0.0253	-0.1035*	-0.0148	-0.0548*	-0.0507*
Rule of Law	0.002	0.0986*	0.0789*	-0.0493*	0.0923*	-0.0172	-0.0095	-0.0752*	-0.0768*	-0.1285*	0.0761*
Political Stability	-0.007	-0.0213	-0.1229*	0.0851*	-0.0236	0.0812*	-0.0047	0.1678*	-0.1498*	-0.2090*	0.1675*

Table 4. Correlation matrix (Continued)

Variables	12	13	14	15	16	17	18	19	20	21
Regulation	1									
Target Market	-0.2165*	1								
Scale of operation	-0.2297*	0.0882*	1							
Board size	0.0708*	-0.0949*	-0.0044	1						
Female	-0.0668*	-0.0285	0.0711*	-0.0025	1					
GDP Growth	0.2696*	0.0875*	-0.0388	-0.022	-0.0233	1				
Inflation/GDP	0.0500*	0.1456*	0.0645*	-0.0626*	-0.0655*	0.1184*	1			
Financial Sector Development	-0.0480*	0.0849*	0.0321	0.0057	-0.0138	-0.0428	-0.0929*	1		
Rule of Law	-0.1322*	0.3365*	0.0314	0.0169	-0.0997*	0.1337*	-0.04	0.4491*	1	
Political Stability	0.2409*	0.1390*	-0.1478*	-0.0381	-0.0379	0.2230*	0.1928*	-0.0794*	-0.2934*	1

This Table presents the correlation coefficients among all variables used in regression tests. All variables are as defined in Table 1. *indicates statistical significance at the 5%.

Table 5. Results of the influence of buffer on ROA and OSS

Variables	ROA		OSS	
	(1)	(2)	(3)	(4)
Buffer Capital	-0.1015*** (-4.54)	-0.1628*** (-5.92)	-0.5394*** (-4.05)	-0.6952*** (-4.12)
Loan portfolio quality (Par30)	-0.1108*** (-11.39)	-0.2771*** (-7.10)	-0.2388*** (-3.28)	-0.6820*** (-2.81)
Buffer Capital * Par30		0.6652*** (4.54)		1.7591** (2.20)
Outstanding Loan Portfolio	0.0096*** (7.48)	0.0091*** (6.91)	0.1225*** (5.26)	0.1214*** (5.31)
Size (log) (\$ Million)	-0.0013*** (-2.83)	-0.0013*** (-2.81)	-0.0257*** (-7.11)	-0.0256*** (-7.11)
Expenses/Assets	-0.0373*** (-4.31)	-0.0332*** (-3.84)	-0.4345*** (-4.58)	-0.4224*** (-4.41)
Leverage	0.0167*** (5.17)	0.0167*** (5.17)	0.0411 (1.63)	0.0415 (1.63)
Age	-0.0011 (-0.99)	-0.0010 (-0.91)	-0.0025 (-0.36)	-0.0021 (-0.30)
Outreach	0.0011 (1.61)	0.0010 (1.48)	0.0080*** (2.78)	0.0078*** (2.71)
Profit Status	-0.0009 (-0.65)	-0.0010 (-0.75)	-0.0021 (-0.30)	-0.0025 (-0.35)
Regulation	-0.0013 (-0.86)	-0.0012 (-0.83)	0.0091 (1.02)	0.0093 (1.05)
Target Market	-0.0000 (-0.03)	0.0001 (0.09)	0.0161*** (3.72)	0.0163*** (3.74)
Scale of operation	0.0015* (1.67)	0.0014* (1.65)	0.0009 (0.33)	0.0007 (0.27)
Board size	-0.0000 (-1.52)	-0.0000 (-1.35)	0.0000 (0.52)	0.0000 (0.65)
Female	0.0294*** (6.59)	0.0291*** (6.53)	0.0557*** (4.14)	0.0546*** (4.05)
GDP Growth	0.0264 (0.84)	0.0211 (0.68)	-0.3485** (-2.27)	-0.3607** (-2.34)
Inflation/GDP	0.0075 (0.79)	0.0057 (0.60)	-0.0615 (-1.39)	-0.0663 (-1.48)
Financial Sector Development	0.0036 (0.73)	0.0033 (0.66)	0.0274 (0.89)	0.0257 (0.83)
Rule of Law	0.0011 (0.63)	0.0012 (0.70)	0.0079 (0.68)	0.0086 (0.74)
Political Stability	0.0002 (0.21)	0.0002 (0.22)	-0.0063 (-1.13)	-0.0062 (-1.10)
Constant	0.0611*** (4.73)	0.0766*** (5.67)	1.7359*** (19.41)	1.7760*** (18.70)
Year Effects	Yes	Yes	Yes	Yes

R-Sq	0.3514	0.3560	0.3399	0.3396
Chi-Sq	422.72***	437.39***	217.54***	217.09***
N	1708	1708	1708	1708

The Table shows the fixed effects regression results of the relationship between buffer capital and ROA (columns 1 and 2) and OSS (columns 3 and 4) with robust standard errors and control for year-fixed effects. All variables are defined in Table 1. *t*-statistics are shown in parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 6. Results based on deposit-takers, profit status and regulated MFIs

Variables	Deposit-takers		Profit status		Regulated MFIs	
	(1)	(2)	(3)	(4)	(5)	(6)
Buffer Capital	-0.0737** (-1.97)	-0.1129*** (-2.63)	-0.0850*** (-2.77)	-0.1602*** (-4.52)	-0.0970*** (-3.42)	-0.1497*** (-4.23)
Loan portfolio quality (Par30)	-0.0927*** (-4.87)	-0.2251*** (-3.27)	-0.1136*** (-8.62)	-0.3192*** (-6.59)	-0.1166*** (-8.62)	-0.2560*** (-5.26)
Buffer Capital * Par30		0.5234** (2.06)		0.8632*** (4.63)		0.5970*** (3.12)
Outstanding Loan Portfolio	0.0133 (1.30)	0.0104 (1.03)	0.0093*** (8.71)	0.0090*** (7.72)	0.0101*** (7.70)	0.0098*** (7.32)
Size (log) (\$ Million)	-0.0006 (-0.77)	-0.0005 (-0.71)	-0.0013** (-2.41)	-0.0011** (-2.16)	-0.0012** (-2.22)	-0.0012** (-2.19)
Expenses/Assets	-0.4452*** (-4.14)	-0.4502*** (-4.20)	-0.0157** (-2.28)	-0.0117* (-1.72)	-0.0307*** (-3.67)	-0.0285*** (-3.35)
Leverage	0.0308*** (4.05)	0.0311*** (4.08)	0.0108** (2.26)	0.0108** (2.29)	0.0164*** (3.70)	0.0167*** (3.78)
Age	-0.0003 (-0.14)	-0.0003 (-0.17)	-0.0007 (-0.54)	-0.0008 (-0.65)	-0.0014 (-0.96)	-0.0014 (-0.98)
Outreach	-0.0002 (-0.17)	-0.0003 (-0.28)	0.0018* (1.87)	0.0017* (1.87)	0.0012 (1.28)	0.0011 (1.22)
Profit Status	-0.0014 (-0.57)	-0.0017 (-0.67)			-0.0005 (-0.28)	-0.0006 (-0.32)
Regulation	-0.0068** (-2.37)	-0.0064** (-2.19)	-0.0013 (-0.56)	-0.0010 (-0.42)		
Target Market	-0.0023* (-1.71)	-0.0024* (-1.78)	-0.0009 (-0.86)	-0.0011 (-1.10)	-0.0013 (-1.36)	-0.0012 (-1.31)
Scale of operation	0.0003 (0.18)	0.0004 (0.26)	0.0009 (0.83)	0.0009 (0.87)	0.0018* (1.71)	0.0018* (1.68)
Board size	-0.0000 (-0.34)	-0.0000 (-0.08)	-0.0002*** (-5.03)	-0.0002*** (-4.68)	-0.0000 (-1.50)	-0.0000 (-1.36)
Female	0.0306*** (4.23)	0.0304*** (4.20)	0.0267*** (3.66)	0.0276*** (3.77)	0.0301*** (4.93)	0.0304*** (4.99)
GDP Growth	0.1064* (1.89)	0.1061* (1.89)	0.0404 (0.91)	0.0315 (0.73)	0.0465 (1.11)	0.0384 (0.92)
Inflation/GDP	0.0539** (2.32)	0.0542** (2.33)	0.0067 (0.38)	0.0032 (0.18)	0.0138 (1.19)	0.0128 (1.11)
Financial Sector Development	0.0068 (0.95)	0.0070 (0.98)	-0.0015 (-0.22)	-0.0036 (-0.57)	-0.0016 (-0.23)	-0.0029 (-0.43)
Rule of Law	0.0003 (0.09)	0.0007 (0.24)	0.0003 (0.12)	0.0010 (0.37)	0.0007 (0.31)	0.0010 (0.46)
Political Stability	0.0004 (0.23)	0.0007 (0.38)	0.0013 (0.78)	0.0019 (1.18)	-0.0000 (-0.02)	0.0002 (0.14)
Constant	0.1104*** (4.16)	0.1233*** (4.42)	0.0579*** (3.91)	0.0759*** (4.98)	0.0592*** (3.53)	0.0725*** (4.02)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes

R-Sq	0.3487	0.3489	0.3710	0.3870	0.3606	0.3675
Chi-Sq	215.82***	212.29***	331.38***	323.99***	232.01***	233.86***
N	590	590	726	726	1002	1002

The Table shows the fixed effects regression results of the relationship between buffer capital and performance of deposit-taking MFIs (columns 1 and 2), profit status MFIs (columns 3 and 4) and regulated MFIs (columns 5 and 6) with robust standard errors and control for year-fixed effects. The dependent variable in all columns is ROA. All variables are defined in Table 1. *t-statistics* are shown in parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 7. Alternative measure of performance, buffer capital and loan portfolio quality

Variables	EFFICIENCY		ROA		OLPG	
	(1)	(2)	(3)	(4)	(5)	(6)
Buffer capital	-1.5615*** (-5.16)	-1.9115*** (-5.01)			-0.0773** (-2.50)	-0.2509*** (-5.14)
Buffer capital (1)			-0.0938*** (-40.30)	-0.1229*** (-19.49)		
Loan portfolio quality (Par30)	-1.1524*** (-6.70)	-2.1522*** (-3.84)	-0.0528*** (-7.36)	-0.1635*** (-5.52)		
Buffer Capital * Par30		3.9657** (2.17)				
Buffer Capital (1) * Par30				0.3685*** (4.25)		
Outstanding Loan Portfolio growth (OLPG)					-0.0460* (-1.87)	-0.3565*** (-4.92)
Buffer Capital * OLPG						1.4704*** (4.32)
Outstanding Loan Portfolio	0.3051*** (4.45)	0.3028*** (4.48)	0.0075*** (5.92)	0.0070*** (5.53)	0.0122** (2.52)	0.0102** (2.20)
Size (log) (\$ Million)	-0.0629*** (-7.23)	-0.0629*** (-7.24)	-0.0013*** (-4.64)	-0.0012*** (-4.28)	-0.0001 (-0.20)	-0.0001 (-0.13)
Expenses/Assets	-1.1009*** (-5.14)	-1.0733*** (-4.98)	-0.0233*** (-4.42)	-0.0204*** (-3.97)	-0.0741*** (-2.87)	-0.0673*** (-2.91)
Leverage	0.0272 (0.49)	0.0281 (0.50)	0.0097*** (4.44)	0.0092*** (4.24)	0.0246*** (5.13)	0.0223*** (4.75)
Age	-0.0068 (-0.41)	-0.0058 (-0.35)	-0.0009 (-1.13)	-0.0009 (-1.19)	-0.0029* (-1.74)	-0.0022 (-1.28)
Outreach	0.0024 (0.40)	0.0019 (0.31)	0.0008* (1.76)	0.0009* (1.92)	0.0016* (1.72)	0.0016* (1.82)
Profit Status	-0.0089 (-0.54)	-0.0096 (-0.59)	-0.0014 (-1.57)	-0.0013 (-1.45)	-0.0012 (-0.60)	-0.0010 (-0.53)
Regulation	0.0359* (1.75)	0.0365* (1.78)	-0.0006 (-0.60)	-0.0005 (-0.47)	-0.0037* (-1.83)	-0.0038* (-1.91)
Target Market	0.0414*** (4.03)	0.0419*** (4.07)	0.0004 (0.78)	0.0002 (0.49)	0.0008 (0.80)	0.0012 (1.35)
Scale of operation	-0.0072 (-1.31)	-0.0076 (-1.37)	0.0009 (1.53)	0.0009 (1.58)	0.0007 (0.64)	0.0007 (0.62)
Board size	0.0001 (1.11)	0.0001 (1.29)	0.0000 (1.49)	0.0000 (0.88)	-0.0001*** (-4.97)	-0.0001*** (-5.51)
Female	0.0842*** (2.78)	0.0816*** (2.68)	0.0235*** (7.32)	0.0238*** (7.39)	0.0226*** (3.90)	0.0207*** (3.58)
GDP Growth	-1.2087*** (-3.51)	-1.2355*** (-3.58)	0.0456*** (2.93)	0.0476*** (3.12)	0.0031 (0.07)	0.0047 (0.10)
Inflation/GDP	-0.2305** (-2.26)	-0.2413** (-2.33)	0.0079 (1.13)	0.0082 (1.26)	-0.0317 (-1.52)	-0.0268 (-1.40)
Financial Sector Development	0.0250	0.0207	0.0062* (1.93)	0.0055* (1.81)	0.0051 (1.52)	0.0021 (0.62)

	(0.35)	(0.29)	(1.83)	(1.68)	(0.88)	(0.40)
Rule of Law	0.0140	0.0157	0.0001	0.0003	-0.0000	0.0010
	(0.54)	(0.60)	(0.08)	(0.30)	(-0.00)	(0.53)
Political Stability	-0.0278**	-0.0274**	-0.0005	-0.0003	-0.0013	-0.0010
	(-2.19)	(-2.16)	(-0.77)	(-0.47)	(-0.98)	(-0.77)
Constant	1.9529***	2.0429***	0.0566***	0.0630***	0.0397**	0.0779***
	(9.18)	(9.02)	(8.10)	(9.08)	(2.18)	(4.22)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-Sq	0.4194	0.4197	0.4005	0.4000	0.2440	0.2777
Chi-Sq	378.87***	394.77***	217.54***	217.09***	139.98***	189.91***
N	1708	1708	1708	1708	857	857

The Table shows the fixed effects regression results of the relationship between buffer capital and efficiency (columns 1 and 2), buffer capital (1) and ROA (columns 3 and 4) and outstanding loan portfolio growth (columns 5 and 6). Buffer capital (1) is defined as capital ratio minus capital adequacy. We report the unstandardised coefficients. All variables are defined in Table 1. *t*-statistics are shown in parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 8. Results based on 2SLS, Hausman-Taylor Estimation and selection bias

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Buffer Capital [^]		-1.2404*** (-2.88)				
Buffer Capital			-0.0991*** (-5.25)	-0.1671*** (-6.24)	-0.0885*** (-3.75)	-0.1539*** (-5.10)
Loan portfolio quality (Par30)	-0.0322*** (4.54)	-0.2056*** (-5.16)	-0.0797*** (-4.51)	-0.2933*** (-4.70)	-0.1139*** (-11.08)	-0.2870*** (-6.75)
Buffer Capital * Par30				0.8400*** (3.57)		0.6940*** (4.34)
Uncertainty Avoidance	0.0612*** (2.68)					
Outstanding Loan Portfolio	0.0095*** (4.57)	0.0149*** (3.89)	0.0110** (2.21)	0.0102** (2.05)	0.0095*** (7.39)	0.0090*** (6.75)
Size (log) (\$ Million)	-0.0058*** (-10.96)	-0.0071*** (-3.02)	-0.0016 (-1.47)	-0.0017 (-1.60)	-0.0014*** (-2.79)	-0.0013*** (-2.80)
Expenses/Assets	-0.0384*** (-4.41)	-0.0608*** (-3.73)	-0.0522*** (-5.15)	-0.0450*** (-4.37)	-0.0337*** (-4.02)	-0.0296*** (-3.51)
Leverage	0.0019 (0.42)	0.0257*** (4.58)	0.0204*** (3.93)	0.0210*** (4.06)	0.0169*** (5.11)	0.0170*** (5.15)
Age	0.0001 (0.09)	0.0000 (0.03)	-0.0010 (-0.73)	-0.0007 (-0.53)	-0.0009 (-0.82)	-0.0008 (-0.73)
Outreach	-0.0098*** (-12.11)	-0.0101** (-2.36)	0.0010 (1.30)	0.0009 (1.17)	0.0013 (1.64)	0.0012 (1.53)
Profit Status	-0.0094*** (-6.46)	-0.0101** (-2.56)	-0.0018 (-0.96)	-0.0017 (-0.94)	-0.0007 (-0.45)	-0.0009 (-0.59)
Regulation	-0.0163*** (-7.58)	-0.0161*** (-2.78)	-0.0006 (-0.28)	-0.0003 (-0.18)	-0.0011 (-0.71)	-0.0011 (-0.72)
Target Market	0.0151*** (18.70)	0.0152*** (2.59)	0.0001 (0.17)	0.0001 (0.09)	-0.0001 (-0.14)	-0.0001 (-0.07)
Scale of operation	-0.0082*** (-9.76)	-0.0071** (-2.03)	0.0012 (1.07)	0.0011 (1.00)	0.0017* (1.74)	0.0016* (1.71)
Board size	-0.0001** (-2.18)	-0.0001 (-1.58)	-0.0001** (-2.26)	-0.0001** (-2.09)	-0.0000 (-1.43)	-0.0000 (-1.27)
Female	-0.0050* (-1.72)	0.0258*** (6.32)	0.0266*** (5.79)	0.0258*** (5.62)	0.0304*** (6.44)	0.0302*** (6.39)
GDP Growth	-0.7322*** (-22.18)	-0.7810** (-2.49)	0.0043 (0.15)	0.0041 (0.14)	0.0375 (1.10)	0.0334 (0.99)
Inflation/GDP	-0.2152*** (-16.63)	-0.2390** (-2.51)	0.0001 (0.01)	-0.0011 (-0.09)	0.0111 (1.15)	0.0089 (0.92)
Financial Sector Development	0.0313*** (6.34)	0.0366*** (2.67)	0.0040 (0.82)	0.0032 (0.68)	0.0038 (0.75)	0.0035 (0.69)
Rule of Law	-0.0109*** (-6.58)	-0.0125** (-2.29)	0.0011 (0.57)	0.0014 (0.75)	0.0014 (0.73)	0.0015 (0.77)
Political Stability	-0.0155*** (-14.30)	-0.0174** (-2.55)	-0.0005 (-0.40)	-0.0003 (-0.22)	0.0004 (0.31)	0.0004 (0.32)

Constant	0.3879*** (34.16)	0.5167*** (2.97)	-0.0344 (-0.04)	0.0027 (0.00)	0.0556*** (4.14)	0.0723*** (5.06)
DHW test of endogeneity	-	18.8405***	-	-	0.3588	0.3635
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
Chi-Sq	230.67***	198.45***	222.72***	237.30***	403.69***	415.49***
N	1708	1708	1708	1708	1438	1438

The Table shows the second stage estimations of the 2SLS regression results (column 1), the Hausman–Taylor estimation regression results (columns 2 and 3) and selection bias results (columns 4 and 5). We report the unstandardised coefficients. The dependent variable is ROA in all columns. All variables are defined in Table 1. *t*-statistics are shown in parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Table 9. Coefficient Stability Method – Omitted Variable Bias Test

			Controlled regression			Uncontrolled regression		Interpretation		
			(1)	(2)		(3)	(4)		(5)	(6)
Table	Regression	Variables	Coefficient from the regression	95% confidence intervals of the estimated coefficient		R-squared of the regression	Identified set of bounds (controlled – Full set)		Coefficient moves away from zero	Coefficient falls within the 95% confidence intervals
5	Column 1	Buffer capital	-0.1015	-0.1769	0.0007	0.3514	-0.1015	-0.0606	Yes	Yes
	Column 2	Buffer capital *par30	0.6652	0.3470	1.3207	0.3560	0.6652	-0.4115	Yes	Yes
	Column 3	Buffer capital	-0.5394	-2.1108	0.8200	0.3399	-0.5394	0.1379	Yes	Yes
	Column 4	Buffer capital*par30	1.7591	1.0457	8.1381	0.3396	1.7591	-5.9890	No	Yes

This Table presents the results of the test for potential omitted variables following the approach of Oster (2019). As recommended by Oster (2019). We run the methods of coefficient stability for our main regressions in Table 5. Columns (1), (2) and (3) show the coefficients, confidence intervals and the R-squared from the main regressions. Columns (5) and (6) report whether the bias-adjusted coefficient β^* in the identified set bounds meets the two robustness criteria in Oster (2019), specifically column (5) reports if the bias adjusted coefficient moves further away from zero and column (6) reports whether the changes in the adjusted coefficient fall within the 95% confidence intervals of the estimated coefficient β in the main regression. All variables are as defined in Table 1.