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Lending Behavior of Microfinance Institutions in Sub-Saharan Africa: Does Capitalization Matter?

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Apr. 2021

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Lending Behavior of Microfinance Institutions in Sub-Saharan Africa: Does Capitalization Matter?

A dissertation submitted to the College of Business and Economics, Bahir Dar University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Accounting and Finance

By

Tilahun Aemiro Tehulu, Asst. Prof.

Under the Guidance of

Prof. Merouane Lakehal-Ayat

Apr. 2021

Bahir Dar

Declaration

This is to certify that the dissertation entitled “Lending Behavior of Microfinance Institutions in Sub-Saharan Africa: Does Capitalization Matter?”, submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Accounting and Finance at Department of Accounting and Finance, Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

Tilahun Aemiro Tehulu, Asst. Prof.	_____	_____
Name of the candidate	Signature	Date

Advisor's Approval Form

Bahir Dar University

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Approval of Dissertation for Defense

I hereby certify that I have supervised, read, and evaluated this dissertation titled "Lending Behavior of Microfinance Institutions in Sub-Saharan Africa: Does Capitalization Matter?" by Tilahun Aemiro Tehulu prepared under my guidance. I recommend the dissertation be submitted for oral defense.

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Advisor's name	Signature	Date

Examiners' Approval Form

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College of Business and Economics

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PhD Dissertation Approval

As members of the board of examiners, we have examined this dissertation entitled "Lending Behavior of Microfinance Institutions in Sub-Saharan Africa: Does Capitalization Matter?" by Tilahun Aemiro Tehulu. We hereby certify that the dissertation is accepted for fulfilling the requirements for the award of the degree of Doctor of Philosophy in Accounting and Finance.

Board of Examiners

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Dedication

To my family and in memory of my father *Merigeta* Aemiro Tehulu and my mother *Woizero* Arefe-aynie Tiruneh for their love and support

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First and foremost, I would like to thank the Almighty God for giving me the strength, knowledge, skill, and opportunity to undertake this PhD study and complete it successfully. My gratitude also goes to Bahir Dar University and the College of Business and Economics for introducing this PhD program and allowing me to pursue my PhD. I also thank my supervisor Prof. Merouane Lakehal-Ayat for his encouragement, guidance, and kindness.

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Abstract

The first core goal of sustainable development goals (SDGs) is to eradicate poverty. While microfinance institutions (MFIs) are considered important instruments for poverty alleviation in developing countries as they provide credit access to the poor, there is surprisingly little evidence of the drivers of the lending behavior of microfinance institutions. Accordingly, we examined the determinants of MFI credit growth using a sample of 130 MFIs operating across 31 countries in Sub-Saharan Africa (SSA) during the period 2004–2014. Using the Arellano-Bover/Blundell-Bond two-step Generalized Method of Moments (GMM) Windmeijer bias-corrected standard errors, we show that both MFI specific and macroeconomic factors matter in the lending behavior of MFIs. We found that while capitalization, liquidity, and size are positively associated with credit growth, profitability negatively impacts credit growth. Besides, the findings regarding scale effects show that lower gross loan portfolio (GLP) in the preceding year amplifies the magnitude of the current credit growth rate, but higher GLP reduces credit growth rates. However, other MFI specific factors namely portfolio quality, deposit growth, and non-deposit borrowing growth have little direct effects on MFI credit growth. Furthermore, we uncovered that MFI credit growth is pro-cyclical but negatively related to GDP per capita consistent with the theory of convergence. On the other hand, inflation and employment are not important covariates in the lending behavior of MFIs. Similarly, profit status, regulation status, legal status, and location do not matter in the credit growth of MFIs, other things constant. Additionally, we found marginal persistency in the credit growth of MFIs in SSA. Using different specifications and estimation methodologies, overlapping rolling regressions, and time varying analysis, we ascertain that our empirical findings are robust. Nevertheless, the time varying analysis revealed that the catch-up phenomenon is stronger during and subsequent to the global financial crisis. We also found that credit growth is negatively related to inflation during and prior to the global financial crisis, though statistically insignificant; whereas, its effect subsequent to the crisis period is positive and statistically significant. Finally, although credit growth is positively related to capitalization (as measured by the book capital ratio), the findings fail to support the hypothesis that capitalization impacts MFI lending behavior through the divergence between the actual capital ratio and the implicit

target capital. Our findings have several practical and theoretical implications which are discussed in the Conclusions part of the paper. Some research areas for further investigation are also identified and suggested as part of the Conclusions of the study.

Keywords: Credit growth, Capital surplus/shortfall, Counter-cyclical capital buffer, Pro-cyclicality, Poverty reduction, Sustainability, Target capital, Sub-Saharan Africa

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CHAPTER 1: INTRODUCTION

''Money … makes money. When you have got a little, it is often easy to get more. The great difficulty is to get that little.'' (Smith, 1998:133–134)

1.1 Background and Problem Statement

Poverty alleviation is the first core goal of Sustainable Development Goals (SDGs)[1]. One of the major constraints facing the poor is lack of access to credit (Tehulu, 2019; Akoh, 2020). Access to credit is vital for the development of the private and informal sectors of an economy and hence, microfinance is considered a vital tool in order to achieve meaningful poverty reduction strategy (Kamusaala, 2016). Accordingly, many developing countries and development oriented donor agencies (multilateral, bilateral and private) have been involved in the promotion of microfinance programs (Ahmed, 2009). In many developing economies, microfinance has become a much favored instrument for poverty alleviation (Kyereboah-Coleman, 2007; Krauss & Walter, 2009; Ahmed, 2009). Given the significant number of poor people throughout the world, expanding access to microfinance institutions (MFIs) for as many people as possible is essential and has been the main reason for the growth of the microfinance sector (Bakker, Schaveling & Nijhof, 2014).

The proverb says, ''Money … makes money. When you have got a little, it is often easy to get more. The great difficulty is to get that little'' (Smith, 1998:133–134). A collateral free working capital loan helps the poor start feasible income generating activities

[1] The 2030 Sustainable Development Agenda builds on the Millennium Development Goals (MDGs) and seeks to address what these did not achieve. While the 2030 Agenda has 17 SDGs and 169 targets that are integrated and indivisible and involve the entire world, developed and developing countries alike, it recognizes that eradicating poverty is the greatest global challenge and an indispensable requirement for sustainable development (https://sustainabledevelopment.un.org/post2015/transformingourworld).

(Ahmed, 2009). It is with this background that, microfinance is seen as one of the significant approaches to poverty alleviation. In this regard, impact assessment studies (Khandker, 2005; Khanam, Mohiuddin, Hoque, & Weber, 2018; Elsafi, 2020) have revealed that access to microfinance contributes to poverty reduction. Similarly, a study by Quaye (2011) revealed that MFIs have a positive effect on the growth of SMEs through greater access to credit, savings enhancement and provision of business, financial and managerial training. In their review, Littlefield, Morduch, and Hashemi (2003) also identified that most impact evaluation studies reported a positive impact on income and assets[2]. It is in this respect that we claim microfinance institutions are very essential.

For sustainable poverty alleviation, however, the MFIs themselves should be sustainable (Tehulu, 2013). The financial sustainability of MFIs is necessary since unsustainable MFIs will not help the poor in the future because the MFIs will be gone (Schreiner, 2000). According to Nyamsogoro (2010), it is better not to have MFIs than having unsustainable ones indicating how important the sustainability of MFIs is. Given the relation between the wellbeing of the microfinance sector and their role in poverty eradication, knowledge of the underlying factors that influence the sectors' performance is therefore essential not only for the managers of the MFIs but also for numerous stakeholders such as the central bank, governments, and other financial authorities (Tehulu, 2013).

[2] Even in other few studies (e.g. Banerjee, Duflo, Glennerster & Kinnan, 2009; Karlan & Zinman, 2010) which failed to find evidence that microfinance alleviates poverty, Littlefield et al. (2003) argue that this does not necessarily mean that MFIs are not important in the fight against poverty but it tells that it is difficult for those studies to demonstrate the impact of microfinance quantitatively for methodological reasons.

As a matter of fact, the loan portfolio constitutes the highest earning asset in the portfolio of MFIs. Moreover, loans represent a significant proportion of the total assets of MFIs (Tchakoute Tchuigoua, 2015). The recent attention of empirical research on drivers of portfolio risk in microfinance institutions (Ayayi, 2012; Ramírez Silva, Cruz Aké & Venegas Martínez, 2015; Lassoued, 2017; Chikalipah, 2018; Schulte & Winkler, 2019) also establishes a strong evidence that lending behavior is a strategic area in the decision of MFIs.

Empirical research has also revealed that MFI lending decisions matter in poverty alleviation (Imai, Gaiha, Thapa, and Annim, 2012; Khanam *et al*., 2018; Elsafi, 2020). Specifically, Imai *et al*. (2012) found evidence that countries with larger microfinance institutions' gross loan portfolio per capita experience lower levels of poverty. Similarly, Khanam *et al*. (2018) and Elsafi (2020) have uncovered that the magnitude of MFI's loans granted to the poor have a significant positive impact on poverty alleviation and hence, enhance the living standard of the poor by increasing their income. These evidences clearly establish the significance of lending decisions in assuring the wellbeing of the microfinance sector and in poverty eradication, the twin bottomline of MFIs. As the microfinance sector grows larger in size, the lending behavior of MFIs could also be critical for the stability of the macro-economy. Therefore, the need for studying the drivers of credit growth in microfinance institutions is obvious.

Although numerous studies are done on MFIs, empirical research on the determinants of lending behavior in microfinance institutions is virtually missing. Many of the prior studies on MFIs have focused on determinants of sustainability (Nyamsogoro, 2010;

Ayayi & Sene, 2010; Ahlin et al., 2011; Tehulu, 2013), drivers of portfolio risk (Crabb & Keller, 2006; D'Espallier et al, 2009; Ayayi, 2012; Ramírez Silva et al., 2015; Lassoued, 2017; Chikalipah, 2018), microfinance and mission drift (Jia, Cull, Guo & Ma, 2016; Caserta, Monteleone & Reito, 2018), governance and MFIs' performance (Mersland & Strøm, 2009; Strøm, D'Espallier & Mersland, 2014; Bibi, Balli, Matthews & Tripe, 2018), efficiency of MFIs (Gutiérrez-Nieto, Serrano-Cinca & Mar-Moline, 2007; Widiarto & Emrouznejad, 2015), financial performance and social efficiency (Louis, Seret & Baesens, 2013), impact of gender on MFIs' performance (Boehe & Cruz, 2013; Bibi et al., 2018), microfinance borrower repayment performance (Mirpourian, Caragliu, Di Maio, Landoni & Rusinà, 2016), and impact assessment (see Morduch & Haley (2002) for a comprehensive review of those studies).

A review of the literature shows that several studies examined the drivers of lending behavior using empirical evidence from the banking industry (Gambacorta & Mistrulli, 2003; Berrospide & Edge, 2010; Thibaut & Mathias, 2014; Cucinelli, 2016; and Gambacorta & Shin, 2018). Nevertheless, while prior empirical research used either the capital-to-asset ratio directly (Berrospide & Edge, 2010; Laidroo, 2012; Carlson, Shan & Warusawitharana, 2013; Cucinelli, 2016; Gambacorta & Shin, 2018) or the capital adequacy ratio/regulatory based capital surplus/shortfall (Gambacorta & Mistrulli, 2004; Karmakar & Mok, 2013; Carlson et al., 2013; Covas, 2016), studies that build on the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework and examine whether capital impacts lending through the divergence between the actual level of capital and the desired level of capital (i.e the implicit target) are missing.

The capital crunch hypothesis tells that the most recent level of the capital-asset ratio is relevant to future lending, since it is the current level that must meet regulatory standards (Bernanke & Lown, 1991). Accordingly, the prior studies examined whether the capital-asset ratio impacts lending directly (Bernanke & Lown, 1991; Berrospide & Edge, 2010; Laidroo, 2012; Gambacorta & Shin, 2018). This approach, however, failed to take into account the regulatory minima.

Accordingly, the previous studies also used a different mechanism to study how capital can affect lending behavior (Bolton & Freixas, 2001; Thakor, 1996; Gambacorta & Mistrulli, 2003, 2004; Covas, 2016). These papers have explicitly taken into account the minimum regulatory capital requirements. The minimum regulatory capital depends on the total risk weighted asset which in turn depends on the amount of loans granted. Consequently, given imperfections in the market for equities (Myers & Majluf, 1984; Cornett & Tehranian, 1994), a link between capital surplus/shortfall and lending could be expected.

The empirical evidence by Covas (2016) confirms that "banks with higher amounts of capital relative to regulatory requirements are likely to lend more, but an increase in capital requirements will cause banks to lend less" (P.4). Accordingly, they argue that the positive relationship between loan growth and bank equity-to-total asset ratio in the former approach hinges on the positive association of capital surplus/shortfall with lending. Nevertheless, these papers also failed to consider the financial institution's own target capital which also takes into account market constraints apart from its own needs and the regulatory minima, if any. Hence, empirical research is needed to examine the

effect of capitalization on lending behavior through the divergence between the actual level of capital ratio and the implicit target capital ratio (Berrospide & Edge, 2010; Thibaut & Mathias, 2014[3]).

Thibaut and Mathias (2014) argue that even when regulatory capital requirements are not binding, it does not mean that financial institutions are not capital constrained at all; market forces could also influence the level of capitalization required. Besides, the weights applied to asset categories seem to have failed to fully reflect financial institutions' portfolio risk (Vallascas & Hagendorff, 2013); consequently, the Basel accord has required financial institutions to additionally make internal risk assessments in order for capitalization reflect their true risk profile and increase their resilience (Berger, 2010) which makes capital adequacy based on a few risk weights and the minimum capital requirement less useful to studies on capital adjustment and lending behavior.

Moreover, since the microfinance industry is of diverse nature– comprising of both regulated and unregulated MFIs, the risk based capital adequacy ratio and the minimum capital requirements could be less relevant to studies on MFIs. Moreover, data on the risk based capital adequacy ratio and the minimum capital requirement are not available. The second framework (i.e. the regulatory based capital surplus/shortfall) also implicitly assumes that the target capital of MFIs is the regulatory minima. However, in addition to regulatory pressure, other external pressures from market participants including the expectations of institutional and retail depositors and creditors also determine the target capital of MFIs. The managers of different MFIs also have different risk preferences.

[3] This study was made at a macro level

This and other such internal pressures also matter as to what level of capitalization a MFI desires to keep. Using the *deviation* from internal targets also offers the advantage of mitigating potential endogeneity issues because most of the endogenous relations are captured in the target component (Thibaut & Mathias, 2014).

As a result, in line with the literature[4], we assume that each MFI targets an implicit level of capital ratio resulting from market discipline and bounded below by regulatory requirements, if any, and at each period, MFIs try to adjust as much as they can towards this target. Accordingly, the level of actual capital at time *t-1* relative to the MFI's own target capital at time *t* (the *deviation*) could be most relevant to predict the lending behavior of MFIs. However, given that the book capital ratio is easily observable, regulatory authorities may increase supervision of MFIs with relatively low capital ratio (presumably) and such MFIs may try to adjust their capital upwards by limiting loan supply. Hence, this study has tried to test the validity of the first – the book capital ratio – and the third – the *deviation* – framework in this study.

Furthermore, the prior studies also paid attention mostly to the effects of capitalization while evidences on the macroeconomic consequences of capital requirements are scant. Although several empirical evidences establish that financial institution lending behavior is not resilient to GDP shocks (Bikker & Hu, 2002; Quagliariello, 2007; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Laidroo, 2012), in part, since demand for loans is pro-cyclical, loan supply could respond differently to the business cycle depending on the level of capitalization (Gambacorta & Mistrulli, 2003, 2004).

[4] See Berrospide and Edge (2010) and Thibaut & Mathias (2014)

Two reasons could explain the asymmetric effect of economic activity on lending behavior: Firstly, financial institutions deeply involved in relationship lending are likely to smooth lending over the business cycle (Beck, Degryse, De Haas, & Van Horen, 2014) and in this regard, well-capitalized financial institutions could absorb temporary financial difficulties on the part of their borrowers better. Secondly, capital could be associated with the degree of financial institution risk aversion; this is in line with the literature which emphasized a link between risk aversion and capital (Rochet, 1992; Michelangeli & Sette, 2016). Financial instutions with lower risk aversion select ex ante a loan portfolio with higher return and risk and consequently, their borrowers are likely to be more financially fragile and thus more exposed to economic downturns. These concerns raise an important empirical question: Does MFI lending respond differently to economic shocks depending on the level of capitalization?

The main reason for focusing on the role of capitalization in lending behavior comes from the fact that capitalization is a good indicator of financial institution solvency and it is essential to increase the resilience of the financial system. Capital requirement has also become an important regulation area in financial institutions including MFIs. Hence, the study is also vital to offer useful insights to central banks/regulatory authorities and the Basel Committee on the need for a counter cyclical capital buffer requirement in MFIs.

Most importantly, while prior studies provide useful insights mainly on the effects of capitalization, portfolio risk and/or business cycle on lending behavior in the banking industry, empirical evidences from the microfinance industry are virtually missing. In this

respect, the only study is by Wagner and Winkler (2012/2013). In their study of "The vulnerability of microfinance to financial turmoil – evidence from the global financial crisis", Wagner and Winkler examined whether the global financial crisis affected credit growth of MFIs and whether the impact varies depending on MFIs' legal status and the region they are located in.

While the aforementioned study does not focus on MFIs in Sub-Saharan Africa (SSA), it also fails to address whether and how MFIs' capitalization predicts lending behavior. The study does not also examine whether the lending behavior of MFIs is resilient to GDP shocks as well as whether the response of MFIs' lending behavior to GDP shocks depends on the level of capitalization. Other predictor variables such as profitability, liquidity, size[5] of MFIs, and scale effects, among others, are not also accounted by their model and all these limitations could make the validity of their findings questionable as the omission of the aforementioned variables are likely to cause bias in parameter estimates and/or make the hypotheses testing invalid.

While Wagner and Winkler applied a static panel data analysis technique (i.e. fixed effect model), we used a dynamic panel data modeling which is preferred when we have short panel in order to obtain unbiased estimates (Cucinelli, 2016). The use of dynamic panel data modeling analysis (GMM) also allows to use the Sargan test to check whether the instruments are uncorrelated with residuals, and thereby showing whether any omitted variables have affected the validity of the results. Therefore, this study is pioneering in

[5] Wagner and Winkler (2012) measure size using loan portfolio (in USD) of the respective MFI to GDP of the respective country (in USD) which is not an appropriate proxy for size; whereas, Wagner and Winkler (2013) measure size using the number of borrowers. Ignoring the inconsistency, the measure is also not appropriate to represent size in lending behavior models since, obviously, credit expansions drive the number of borrowers/loan portfolio and not the reverse as it is theoretically less sound (See Section 4.5.1.1 for more details).

studying MFI lending behavior using a comprehensive econometric model and advanced data analysis technique. The paper also provides a comprehensive review of the theoretical frameworks and empirical evidences on lending behavior.

There exist three main reasons for focusing on MFI lending behavior. First, while gross loan portfolio is the single most important asset of MFIs, rigorous studies aimed at examining drivers of lending behavior are missing. Second, since MFIs' lending behavior could cause performance cyclicality of MFIs, the need to an in-depth understanding of MFIs' loan growth determinants is obvious. Third, the issue deserves attention as it may provide some clue to central banks/regulatory authorities and the Basel Committee on how to increase MFI's resilience and on the need for a counter-cyclical capital buffer requirement in MFIs.

Accordingly, building on the methodology applied in prior studies in the banking sector in studying capital adjustment decision (Athanasoglou, 2011; Jokipii & Milne, 2011), lending behavior (Cucinelli, 2016), and capital adjustment decision and lending behavior (Berrospide & Edge, 2010; Thibaut & Mathias, 2014;) and in the microfinance industry in studying capital buffer (Tchakoute Tchuigoua, 2016) and credit growth (Wagner & Winkler, 2012), this study, therefore, has examined the lending behavior of microfinance institutions in Sub-Saharan Africa[6] with a primary focus on whether and how capitalization impacts MFI credit growth.

[6] We have chosen to undertake cross-country study rather than focus on a single country (i.e. Ethiopia) as it enables us examine or control for the effects of differences in location, regulation, industry related factors and macroeconomic environment on MFI lending behavior and it also allows a flexible dynamics in the capital adjustment as well. By undertaking a cross-country analysis, it is possible to increase the number of observations and variability of variable values thereby allowing considering potential determinants exhaustively. In the light of the findings, we are able to draw some policy implications that may be useful to MFI managers, policy makers and other stakeholders in the Sub-Saharan Africa economies. Using a rolling regression and a time varying analysis as well as

Despite healthy economic prospects, SSA has the highest share of poor people, with half of the population living below poverty line and the lowest share of banked households in the world (12 percent) (CGAP & World Bank, 2010, cited in CGAP, 2012). With a larger number of poor people in SSA, there is a fertile ground for microfinance and providing these segments of people with access to credit and other financial services will help people engage in income generating activities and employments (Helmore, 2009). Hence, it is imperative that we study the lending behavior of the microfinance sector in this region.

The rationale behind this study also emanates from the fact that the Gross Loan Portfolio (GLP) of MFIs in SSA was the lowest[7] in contrast with the other regions[8] and with significant variability (Table 1 below). The MFIs in SSA were also highly[9] capitalized (with mean capital ratio of 34.31%)[10] and there was significant variation in the level of their capitalization (with δ=22.25%, minimum of 3.6% and maximum of 95.41%). These stylized facts raise three important concerns: (a) What explains the disparity in the lending behavior of MFIs? (b) Does the capitalization of MFIs count for their credit growth? (c) Which framework (the book capital ratio or the *deviation*) has higher predictive power in the capital–credit growth nexus? Therefore, the purpose of this study

other robustness tests, we also ascertained the validity of the results, and thereby increase the usefulness of the study for any country or sub-region.

[7] The mean GLP for other regions viz. East Asia and the Pacific (EAP), Eastern Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), Middle East and North Africa (MENA) and South Asia was USD6,811,602; 9,994,523; 1.32e+07; 1.21e+07 and USD9,790,410

[8] Data from www.mixmarket.org uses six regions namely Africa, East Asia and the Pacific (EAP), Eastern Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), Middle East and North Africa (MENA) and South Asia.

[9] The capital requirement of most countries for MFIs range between 8% to 12% of total risk weighted assets (See Tchakoute Tchuigoua, 2016).

[10] The 25 and 50 percentile values for capital ratio of SSA MFIs are roughly 17% and 28% which prove that the MFIs are highly capitalized and the mean value does not suffer significantly from biases due to extreme values.

is examining the drivers of MFI lending behavior along with whether and how capitalization impacts lending decisions of microfinance institutions in Sub-Saharan Africa, where a significant proportion of the people live below poverty line.

Table 1: *Descriptive Statistics on Key Variables for SSA MFIs*

Variables*	Mean	S.D(δ)	Minimum	Maximum
Capitalization	.3431199	.2225056	.036	.9541
Gross Loan Portfolio	USD6,292,923	1.08e+07	81,128	6.46e+07

Source: Preliminary Analysis Based on MIXMARKET Data (Year 2005–2014)

*In order to avoid outliers, data trimming is made at 2.5th and 97.5th percentile values.

1.2 Objectives of the Study

The general objective of this study is to examine the drivers of MFI credit growth with particular focus on the link between lending behavior and capital adjustment process of MFIs in Sub-Saharan Africa. More specifically, the study tried:

- ✓ To produce stylized facts on the characteristics of the microfinance industry and the macroeconomic environment of countries in Sub-Saharan Africa.
- ✓ To identify which of the firm specific factors (i.e. liquidity, portfolio risk, profitability, size, deposit growth, and non-deposit borrowing growth) determine the lending behavior of microfinance institutions in Sub-Saharan Africa.
- ✓ To examine the effects of macroeconomic factors on lending behavior of MFIs in Sub-Saharan Africa as well as the degree of persistence and the speed of convergence to equilibrium in lending behavior.
- ✓ To investigate the link between lending behavior and capital adjustment process of MFIs in Sub-Saharan Africa along with the degree of persistence and the speed of convergence to equilibrium in capitalization.

1.3 Research Questions

In the light of the problem statement and the objectives of the study identified in section 1.1 and 1.2 above, the study has tried to answer the following research questions:

- ✓ What characterizes the microfinance sector and the macroeconomic environment of countries in Sub-Saharan Africa?
- ✓ Do the firm specific factors including liquidity, portfolio risk, profitability, size, deposit growth, and non-deposit borrowing growth affect the lending behavior of microfinance institutions in Sub-Saharan Africa?
- ✓ Do macroeconomic factors affect the lending behavior of MFIs in Sub-Saharan Africa? What is the degree of persistence in lending behavior and the speed of convergence to equilibrium in this variable?
- ✓ Does capitalization matter in lending decision of MFIs in Sub-Saharan Africa? Which alternative measure of capitalization (equity-to-total asset ratio or capital surplus/shortfall) yields better predictive power to explain lending behavior of MFIs in SSA? What is the degree of persistence and the speed of convergence to equilibrium in capitalization?

1.4 Contributions of the Study

This study is the first study of its kind to examine the drivers of lending behavior in the microfinance industry in SSA. The study could, therefore, contribute to the body of knowledge and practice in the following ways. The study contributes to the literature in at least five ways. First, previous studies focused on bank lending behavior (Bernanke & Lown, 1991; Hancock & Wilcox, 1993, 1994; Gambacorta & Mistrulli, 2003; Berrospide

& Edge, 2010; Thibaut & Mathias, 2014; and Gambacorta & Shin, 2018). To our knowledge, this study is the first comprehensive study to examine the determinants of credit growth of MFIs by incorporating MFI specific, macroeconomic and time invariant components.

Second, our study focused on MFI lending behavior in SSA where the gross loan portfolio (GLP) of MFIs is the lowest compared to the GLP of MFIs in other regions, and thereby providing empirical evidence on MFI lending behavior from developing economies. Third, we used a dynamic model so as to obtain consistent and unbiased estimates of the drivers of MFI lending behavior. The fixed effects estimation technique could be biased given a short panel such as ours and cannot estimate the effects of time invariant components as it drops them from the regression equation.

Fourth, our measure of the level of capitalization (capital surplus/shortfall) of a microfinance sector is very simple and easily replicable since it is based on balance sheet statement and macroeconomic data. This approach also allows considering a much larger number of microfinance institutions which otherwise would not be possible if our measure were based on risk weighted capital since data on capital requirement and risk weighted based capital are not available in the data set.

Fifth, this paper will inspire researchers to replicate the study in the microfinance industry in different regions or countries since this study is the first comprehensive study that examines the determinants of credit growth of MFIs as an extension to lending behavior models from the banking industry. In this respect, the study also contributes to

the literature on lending behavior by showing that MFI capitalization, liquidity, and size are positively associated with credit growth and MFI credit growth is pro-cyclical but negatively related to GDP per capita consistent with the literature in the banking industry. The findings also establish the need to introduce a counter-cyclical capital buffer requirement in the microfinance industry like the one recently introduced in the banking industry. All these findings add to the literature by showing that the lending behavior of MFIs shares the characteristics of bank lending.

The study also provides new insights as to the relationship between credit growth and profitability of financial institutions. Unlike the banking industry where profitability contributes to the credit growth of commercial banks positively, we found new evidence that profitability has a negative effect on credit growth. This adds to the literature and arguments on the profitability–lending nexus in financial institutions in the context of MFIs. Besides, given the mixed prior empirical evidences on the link between credit growth and size of financial institutions, our findings suggest that future research shall control for scale effects since this is likely to be the reason for a negative association of size with credit growth documented in some prior studies.

Given that lending decisions are among the most critical decision areas of MFIs, this study also contributes to practice by uncovering knowledge on the drivers of the lending behavior of MFIs, and thereby enlightening MFI managers, policy makers, and central bank authorities possible ways to address MFI lending decisions and related issues including capital requirement successfully. More specifically, our findings provide several useful insights to policy makers in the following ways. Since MFI capitalization

is positively associated with credit growth and MFI credit growth is pro-cyclical, different measures are needed to increase the financial stability of the microfinance industry. In this respect, the findings imply that, at some point in the future, central banks/regulatory authorities need to introduce a counter-cyclical capital buffer requirement in the microfinance industry.

In particular, in the future when the microfinance industry grows larger as well as faces significant capital constraints as they get more levered, the findings imply that central banks/regulatory authorities should impose a counter-cyclical capital buffer requirement to help MFIs improve their solvency and to be better able to absorb losses and still continue their normal business operations as well as meet capital requirements. The introduction of counter-cyclical capital buffer requirement could also allow MFIs to grant more loans during an economic downturn, and thereby increase aggregate demand and contribute to economic recovery.

In general, the findings suggest that strengthening micro and macro-prudential regulations aimed at improving financial soundness (such as portfolio quality, capitalization, profitability, efficiency, and liquidity) and macroeconomic conditions (to induce economic growth as well as control unhealthy inflation) are essential to sustain the rapid credit growth of MFIs in SSA, and thereby enhancing MFI financial sustainability and eradicating poverty by expanding credit access to the poor, the twin missions of MFIs. The policy and theoretical implications of our study are extensively and thoroughly discussed in Chapter 7 (Conclusions and Policy Implications).

1.5 Scope and Limitations of the Study

The purpose of this study is to identify the drivers of the lending behavior of MFIs in Sub-Saharan Africa, where a significant proportion of the world's poor people live. This study aimed at examining the effects of MFI specific and macroeconomic factors on MFI lending behavior with a primary focus on the link between lending behavior and the capital adjustment process. However, while our model controls for several industry related factors and the location of MFIs, there could be other MFI specific and structural factors that could influence MFI lending behavior that are omitted in our model due to either lack of access to the data or the need to limit the scope as every study has its own delimitations. Given that our model is more comprehensive in terms of incorporating potential determinants and any omitted variables could be studied in future research as every research has its own delimitation, the critical concern for any omitted variable is whether the omission causes bias in parameter estimates.

Omitted variables are serious concerns in research because the coefficient estimates of the included variables will be biased if the error term (it also contains the omitted variables) is correlated with the included variables. In our case, the use of dynamic panel data analysis technique (GMM) has allowed us to use the Sargan test to check whether our models suffer from omitted variables bias or not. In all GMM models, the Sargan test confirmed that our models do not suffer from omitted variables bias.

In this study, we have chosen to undertake a cross-country study rather than focus on a single country (i.e. Ethiopia) as it enables us examine or control for the effects of differences in location, regulation, industry related factors and macroeconomic

environment on MFI lending behavior. A cross-country data also allows a flexible dynamics in the capital adjustment as well. By undertaking a cross-country analysis, it is possible to increase the number of observations and variability of variable values, and thereby allowing considering potential determinants more exhaustively. In the light of the findings, we are able to draw some policy implications that may be useful to MFI managers, policy makers and other stakeholders in the Sub-Saharan Africa economies. Using a rolling regression and a time varying analysis as well as other robustness tests, we have ascertained the validity of our findings, and thereby increasing the usefulness of our study for any country or sub-region.

The study uses a sample of 130 MFIs operating across 31 countries in Sub-Saharan Africa (SSA) during the period 2004–2014. Since invariance/constancy of parameters is an important property of causal models and stability of the results increases the usefulness of our findings to policy making especially given that the time period our dataset covers is not more recent, we have checked the robustness of the results across time periods using a time varying analysis. Moreover, in view of the crucial role of loan portfolio in the financial sustainability of MFIs, poverty eradication, and macro-economic stability, the need for a more in-depth understanding of the lending behavior of MFIs is obvious. Accordingly, given the scope and limitations of our study, we have also indicated some research areas for further investigation as part of the last chapter.

1.6 Structure of the Paper

This study is organized into seven chapters. The first chapter is an introduction which includes background and problem statement, objectives of the study, research questions,

contributions and the structure of the study. Chapter two provides the conceptual framework for our study and is aimed at identifying the main theoretical and empirical works on lending behavior in order to build foundations for the study and to isolate what has been done from what needs to be done regarding the drivers of the lending behavior of MFIs.

Chapter three presents extensive review of empirical evidences concerning the determinants of lending behavior. Due to limited literature on what influences MFIs' lending behavior, this chapter borrows literature from determinants of lending behavior in the conventional banking industry. Chapter four presents data and methodology including research paradigm and research design, sources and nature of data, sampling, econometric models, description and measurement of variables and hypotheses, estimation methodology and robustness tests applied in the study.

In chapter five, we document some stylized facts on the characteristics of the microfinance sector and the macroeconomic environment of countries in Sub-Saharan Africa. Chapter six provides empirical results and discussions on the drivers of MFI lending behavior including whether capitalization predicts lending behavior through the *deviation* (i.e. the divergence between the actual capital ratio and the implicit long-run target capital), the presence or otherwise of non-linear effect of capitalization on MFI credit growth, and on whether the response of MFIs' lending to GDP shocks depends on the level of capitalization. Finally, chapter seven concludes the study with summary of the main findings and conclusions, policy implications, theoretical implications, and suggestions of research areas for further study.

CHAPTER 2: DETERMINANTS OF LENDING BEHAVIOR: A CONCEPTUAL FRAMEWORK

2.1 Introduction

Recent research on lending behavior has drawn attention for several reasons. First, recent developments in the financial sector might have increased firm-specific characteristics' impact on the provision of credit (Gambacorta & Marques-Ibanez, 2011). The second reason is the recent global financial crisis (Schularick & Taylor, 2009) since performance cyclicality is usually triggered by pro-cyclical movements in loan supply (Laidroo, 2012). In other words, financial institutions' lending behavior is a powerful predictor of financial crises. Third, loans are important sources of funds for individuals, households and firms. Lastly, loans also plays a critical role in the profitability of financial institutions ((Muriu, 2011; Tehulu, 2013) and poverty alleviation endeavor (Imai et al, 2012).

Accordingly, numerous studies (Bernanke & Lown, 1991; Hancock & Wilcox, 1993; Hancock & Wilcox 1994; Gambacorta & Mistrulli, 2003; Berrospide & Edge, 2010; Carlson et al., 2013; Wagner & Winkler, 2012; Thibaut & Mathias, 2014; Cucinelli, 2016) have examined the factors that influence lending behavior. In this regard, the prior studies have focused on examining the pro-cyclicality of lending, inter-temporal relationship with portfolio risk and/or effect of capitalization on lending. However, the prior studies were based on empirical data from the banking industry and studies on lending behavior focusing on the microfinance industry are virtually missing.

Many of the prior studies on MFIs have focused on determinants of sustainability (Ayayi & Sene, 2010; Ahlin et al., 2011; Tehulu, 2013), drivers of portfolio risk (Ayayi, 2012; Ramírez Silva et al., 2015; Lassoued, 2017; Chikalipah, 2018), microfinance and mission drift (Jia et al., 2016; Caserta, et al., 2018), governance and MFIs' performance (Mersland & Strøm, 2009; Strøm et al, 2014; Bibi et al., 2018), efficiency of MFIs (Gutiérrez-Nieto et al., 2007; Widiarto & Emrouznejad, 2015), financial performance and social efficiency (Louis et al., 2013), impact of gender on MFIs' performance (Boehe & Cruz, 2013; Bibi et al., 2018), microfinance borrower repayment performance (Mirpourian et al, 2016), and impact assessment (see Morduch & Haley (2002) for a comprehensive review of those studies). Nevertheless, studies on MFI lending behavior are virtually missing. In this study, therefore, we rely on literature from the banking industry.

The literature shows that several theories could explain lending behavior and these theoretical foundations include the capital crunch hypothesis, theories of pro-cyclicality (including over-optimism, loan seasoning/financial accelerator mechanisms, and reduced supervisory toughness or lessened market discipline), availability of loanable funds, portfolio risk–lending nexus theories, agency theory, catching-up effect theory, and regulation, among others. Hence, the aim of this chapter is mainly to discuss these theoretical underpinnings. However, to make our review more complete and to be able to identify gaps in the previous studies, we also include empirical literature. Therefore, in subsequent sections, we discuss the theoretical and empirical literature on lending behavior at the same time identifying the gap in the existing literature. Finally, we provide a summary of the literature with specific focus on the promising research ideas

that we need to address in this research project. The empirical evidences on what drives MFI lending behavior are also discussed in a greater depth separately in chapter 3.

2.2 The Drivers of Lending Behavior

2.2.1 MFI specific determinants of credit growth

2.2.1.1 The capital adjustment process and lending behavior

Several studies establish that capital matters in the lending behavior of financial institutions consistent with the capital crunch hypothesis (Carlson et al., 2013; Thibaut & Mathias, 2014; Covas, 2016; Gambacorta & Shin, 2018). The capital crunch hypothesis tells that the most recent level of the capital-asset ratio is relevant to future lending since it is the current level that must meet regulatory standards (Bernanke & Lown, 1991). It implies that financial institutions with higher capitalization increase loans while those with poor capitalization limit their lending in order to fulfill capital requirement; this shows that lending is positively related to capitalization.

On the other hand, the literature also shows that capitalization may be associated with financial institution risk aversion; this is in line with the literature that has emphasized a link between risk aversion and capital (Rochet, 1992; and Michelangeli & Sette, 2016). Accordingly, the findings by Cucinelli (2016) show that banks with a higher level of equity to total assets reduce lending; this could imply that the higher bank capital, the greater are the incentives for equity holders to reduce the riskiness of assets which thereby limits bank lending activity. To the contrary, Michelangeli and Sette (2016) found that higher bank capital is associated with a higher likelihood of application

acceptance and lower offered interest rates; banks with lower capital reject applications by riskier borrowers and offer lower rates to safer ones. These results suggest that the direction of relationship between loan supply and capitalization could also depend on the link between bank/MFI risk aversion and the level of capitalization.

In addition, the literature shows that there is no consensus as to which framework is best in modeling the relationship between loan growth and capitalization. Some of the prior studies have examined whether the capital-asset ratio impacts lending directly (Bernanke & Lown, 1991; Berrospide & Edge, 2010; Laidroo, 2012; Gambacorta & Shin, 2018). This approach, however, failed to take into account the minimum capital requirement. Hence, the previous studies also used a different mechanism to study how bank capital can affect lending behavior (Bolton & Freixas, 2001; Gambacorta & Mistrulli, 2003, 2004; Covas, 2016). These papers have explicitly taken into account regulatory capital requirements. The minimum regulatory capital depends on the total risk weighted asset which in turn depends on the amount of loans granted. Consequently, given imperfections in the market for equities (Myers & Majluf, 1984; Cornett & Tehranian, 1994), a link between bank capital surplus/shortfall and lending could be expected.

The empirical evidence by Covas (2016) confirms that "banks with higher amounts of capital relative to regulatory requirements are likely to lend more, but an increase in capital requirements will cause banks to lend less" (P.4). Accordingly, they argue that the positive association of bank equity-to-total asset ratio with loan growth in the former approach hinges on the positive relationship between lending and capital surplus/shortfall. Nevertheless, these papers failed to consider the financial institution's

own target capital which also takes into account market constraints apart from its own needs and the regulatory minima, if any. Hence, empirical research is needed to examine the effect of capitalization on lending behavior through the divergence between the actual level of capital ratio and the implicit target capital ratio (Berrospide & Edge, 2010; Thibaut & Mathias, 2014).

Thibaut and Mathias (2014) argue that even when regulatory capital requirements are not binding, it does not mean that financial institutions are not capital constrained at all; market forces could also influence the level of capitalization required. Besides, the weights applied to asset categories seem to have failed to fully reflect banks' portfolio risk (Vallascas & Hagendorff, 2013); consequently, the Basel accord has required financial institutions to additionally make internal risk assessments in order for capitalization reflect their true risk profile and increase their resilience (Berger, 2010) which makes capital adequacy based on a few risk weights and the minimum capital requirement less useful to studies on capital adjustment and lending behavior.

Moreover, since the microfinance industry is of diverse nature – comprising of both regulated and unregulated MFIs, capital requirements could be less relevant to studies on MFIs. Using the deviation from internal targets also offers the advantage of mitigating potential endogeneity issues because most of the endogenous relations are captured in the target component (Thibaut & Mathias, 2014). As a result, in line with the literature[11], we assume that each MFI targets an implicit level of capital ratio resulting from market discipline and bounded below by regulatory requirements, if any, and at each period,

[11] See Berrospide and Edge (2010) and Thibaut & Mathias (2014)

MFIs try to adjust as much as they can towards this target. Accordingly, the level of actual capital at time *t-1* relative to the MFI's own target capital at time *t* could be most relevant to predict the lending behavior of MFIs.

Accordingly, in this study, we employed two ways of modeling the channel going from capital to lending. First, building on Bernanke and Lown (1991) framework we examined whether the capital-to-asset ratio affects loan growth directly. We have presented and discussed the results on the this framework in Section 6.2. In this section, we use the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework applied in the banking industry in which capital impacts lending through the divergence between the actual level of capital and the desired level of capital.

In our study, we do not consider risk-based capital ratios because, on the one hand, these are essentially regulatory concepts for which the relevant target is the threshold that determines whether a financial institution is adequately capitalized which makes less sense to try to develop a model of the target for these capital ratios (Berrospide and Edge, 2010) and additionally since capital requirement based on a few risk weights is not enough to build a resilient MFIs, the Basel accord has recently required financial institutions to additionally make internal risk assessments in order for capitalization reflect their true risk profile and increase their resilience (Berger, 2010) which makes capital adequacy based on a few risk weights less relevant; on the other hand, data on risk based capital ratio are also not available.

The literature also shows that the response of credit growth to capitalization is nonlinear (Carlson et al., 2013; Thibaut & Mathias, 2014). It is argued that the effect of capitalization on loan growth for over-capitalized banks could be less marked since "banks cannot force agents to borrow while they can prevent them from getting funds: the extent of the increase in lending is possibly more sensitive to changes in the demand than the supply of credit" (Thibaut & Mathias, 2014, P.16). Thus, we additionally test the existence of non-linear effect of capitalization on the credit growth of MFIs in SSA.

2.2.1.2 Availability of loanable funds

Financial institutions make loans as long as there are loanable funds such as equity capital, its checking and saving deposits, or its certificates of deposit (CDs). According to the so-called credit view of monetary policy, one channel by which changes in financial institutions' reserves (induced by open market operations) can affect economic activity is by affecting the quantity of funds that financial institutions have to lend (Bernanke & Lown, 1991). Similarly, central banks use reserve requirement as one of the mechanisms to influence money supply by influencing the magnitude of loanable funds which in turn influence financial institutions' loan supply. This establishes the significance of supply factors in loan growth.

Consequently, deposit growth (Olokoyo, 2011; Laidroo, 2012; Cucinelli, 2016) and non-deposit borrowings growth (Wagner & Winkler, 2012) could be important covariates to influence the availability of loanable funds and hence, the lending behavior of financial institutions. Under normal circumstances, the growth of deposits influences the loan growth rate positively since deposits represent the main sources of loanable funds (Hou & Dickinson, 2007 and Tracy, 2011 cited in Cucinelli, 2016). However, Laidroo (2012)

claims that financial institutions with greater deposit holdings are more likely to be affected by runs. The author argues that since reliance on short-term funds increases the vulnerability of financial institutions to economic conditions, higher deposits are more likely to affect financial institutions during crisis periods; this could lead to a negative association with lending growth.

The prior studies also show that liquidity could drive loan supply positively (Gambacorta & Mistrulli, 2003; Berrospide & Edge, 2010; Laidroo, 2012; Hessou & Lai, 2018) as higher liquidity ratio implies the availability of more free cash flows which allow financial institutions to shield their lending activity against shocks to the availability of external finance. In this respect, Laidroo (2012) argues that financial institutions with higher liquidity ratio could be better protected against shocks to their deposits, implying that higher liquidity permits increasing lending and the lending behavior of such financial institutions is less vulnerable to economic shocks. Therefore, deposit growth, non-deposit borrowings, and liquidity which capture availability of loanable funds could also be important factors to explain the variability in MFI lending.

2.2.1.3 The portfolio risk–lending nexus theories

The literature on lending behavior also shows that portfolio risk is one of the important drivers of credit growth. The prior evidences have also revealed that the relationship between credit growth and portfolio risk is a dynamic one. In other words, loan growth affects and is affected by portfolio risk. While most models predict/show a positive relation running from credit growth to portfolio risk (Dell'Ariccia & Marquez, 2006; and Borio, 2014; Cucinelli, 2016), the sign of the feedback effect is ambiguous (Igan & Pinheiro, 2011). Igan and Pinheiro state that it could be that portfolio risk feeds

negatively into credit growth because less sound banks have less capacity (to manage risks or to deploy additional employees) and they can expand less than others or it could be a positive feedback effect since “less sound banks become more aggressive and take more risks as they bet all their resources in a last effort to survive” (P.3).

A higher portfolio risk also implies that the borrowers are less creditworthy which results in lower effective demand for external finance which in turn negatively impacts lending (Bernanke & Lown, 1991). Moreover, a higher portfolio risk could imply lower cash flow which reduces the amount of money to be lent again. It also implies higher loan loss provisioning which depletes capital which in turn forces a bank/MFI to limit its lending. In this connection, the prior studies have documented a negative relationship between credit growth and deterioration in portfolio quality (Igan & Pinheiro, 2011; Wagner & Winkler, 2012).

Wagner and Winkler (2012) found that portfolio risk negatively affects MFI’s real credit growth. They state that an increase in portfolio risk makes MFIs less willing to expand credits in the subsequent year. Similarly, Igan and Pinheiro (2011) uncover that sounder banks tend to grow faster throughout the period; however, in contrast to the late 1990s, the pace of credit growth during 2001–05 is less dependent on bank soundness suggesting that the strength of the relationship is time dependent. Hence, it is imperative to include portfolio risk in the lending behavior models since it is one of the drivers of credit growth.

2.2.1.4 Other MFI-specific determinants

The other MFI-specific determinants of credit growth include size and profitability of MFIs. Size may influence MFIs' credit supply positively since large MFIs can attract more loanable funds to support their desired higher credit growth (Hessou & Lai, 2018). Large financial institutions could also enjoy diversification and economy of scale compared to small financial institutions (Aggarwal & Jacques, 2001; Berger, DeYoung, Flannery, Lee & Oztekin, 2008). Laidroo (2012) also argues that size could be positively associated with lending growth as bigger financial institutions have lesser information asymmetries and are less affected by economic shocks. Nevertheless, large and diversified MFIs may hold lower capital buffer since they have a strong risk management culture (Hessou & Lai, 2018). Consequently, the lower capital buffer may pressure MFIs to limit their lending. Empirical evidence on the relationship between credit growth and size of MFIs is, however, missing.

Profitability is also identified as one of the important predictors of loan growth as it allows financial institutions to grow faster (Igan & Pinheiro, 2011). This is consistent with the finding of Laidroo (2012) who confirms that higher profitability of lending is associated with an increase in loan supply. Similarly, Hessou and Lai (2018) show that higher profitability at time *t-1* is followed by subsequent more loan granting. Hessou and Lai argue that, in MFIs which are particulary mutually owned ones such as credit unions, dividends paid to members store up in saving accounts and available for granting new loans. They also argue that credit unions also adjust capital buffers by retaining earnings; this could lead to the positive relationship between lending and profitability.

While the banking industry works for a profit motive, the microfinance industry aims at achieving the dual goals of financial sustainability and social impact. Given differences in commercial orientation among different forms of MFIs and credit risk is a critical obstacle to MFI profitability, whether more profitable MFIs focus more on financial sustainability rather than outreach and therefore, could follow a conservative risk management strategy and limit lending to generate consistently high profits is an empirical question. In credit unions, credit growth does not raise risk management issues since these MFIs require cash collateral. In other forms of MFIs, portfolio risk could be a major impediment to profitability as MFIs may not even require collateral to the loans. Accordingly, we examined the relationship between credit growth and profitability of MFIs.

2.2.2 Macroeconomic factors and credit Growth

2.2.2.1 Theories of pro-/counter-cyclicality of credit growth

Another determinant factor of financial institutions' performance is considered to be the business cycle. In this respect, previous empirical research on financial institutions' pro-cyclical behavior can be divided into two strands (Laidroo, 2012). The first focuses on the cyclicality of financial institutions' performance– the first-round effect (Bikker & Hu, 2002; Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004; Bikker & Metzemakers, 2005; Quagliariello, 2007; Laidroo, 2012). Cyclicality of performance is usually triggered by pro-cyclicality of lending and accompanied with pro-cyclical movements in profits and capital adequacy and counter-cyclical movements in portfolio risk (Laidroo, 2012).

The second focuses on how the financial institutions' reaction to changes in macroeconomic conditions affects macro economy amplifying its performance fluctuations– second-round or feedback effect (Marcucci & Quagliariello, 2008). Our study extends the first strand of research (first-round effect) and investigates cyclicality of MFIs' lending behavior as it is not given any attention in previous research. "… with few exceptions (Di Bella, 2011) most microfinance sectors are small in volume terms" (Wagner & Winkler, 2012, P.7). Consequently, since it is unlikely that microfinance credit growth influences GDP growth or other macroeconomic variables, we are reasonably confident that endogeneity is not a concern regarding macro-economic factors (Ibid).

Several empirical studies reveal that the growth of loans tends to be pro-cyclical (Bikker & Hu, 2002; Gambacorta & Mistrulli, 2004; Quagliariello, 2007; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Laidroo, 2012), with loan losses increasing during a downturn (Bikker & Metzemakers, 2005; Quagliariello, 2007; Glen & Mondragón-Vélez, 2011). Several explanations have been suggested for cyclicality in lending behavior. One theory of pro-cyclicality that focuses on the expansionary part of the business cycle is over-optimism (Berger & Udell, 2004). During an expansion, financial institutions may underestimate their risk exposure and ease their credit standards, which may increase the magnitude of losses in the next downturn. Loan seasoning may also explain an easing of credit standards during an expansion: Observed loan performance problems are low during an expansion, and then rise dramatically during the downturn (Ibid).

The other explanation could be financial accelerator mechanisms. Igan and Pinheiro (2011) assert that financial accelerator mechanisms can explain the pro-cyclicality of loan growth relatively well– that favorable investment opportunities and strong economic activity push asset prices up, which in turn improve the creditworthiness of borrowers and allow them to borrow more against higher values of collateral. When economic downturn occurs, borrowers' financial situation deteriorates, customers become pessimistic, and asset prices fall causing decrease in value of collaterals (Laidroo, 2012) which results in increased defaults and tightening of credit standards.

Reduced supervisory toughness or lessened market discipline may also help explain why higher credit supply occurs during an expansion. Financial institution supervisors were found to reduce toughness (Berger et al., 2001) and capital market participants to exercise less discipline (Covitz et al., 2002) during relatively good periods (cited in Berger & Udell, 2004).

However, prior research also argues that credit growth could be counter cyclical. According to these views, higher economic growth could improve firms' profitability and this could make it possible to rely more on internal funds, reducing credit demand during upturns (Kiss, Nagy, & Vonnák, 2006). Similarly, households and firms might increase debt levels to smooth consumption and finance assets at times when their income is temporarily below expected levels during downturns (Ibid). These could lead to the counter cyclicality of credit growth.

Furthermore, although several studies have examined whether the lending behavior of financial institutions is resilient to GDP shocks (Bikker & Hu, 2002; Gambacorta & Mistrulli, 2004; Quagliariello, 2007; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Laidroo, 2012), evidences on the response of the lending behavior of financial institutions with a different degree of capitalization to a GDP shock are scant. Gambacorta and Mistrulli (2003; 2004) argue that the loan supply of financial institutions could respond differently to the business cycle depending on the level of capitalization. The explanation is two-fold: Firstly, financial institutions deeply involved in relationship lending are likely to smooth lending over the business cycle (Beck et al., 2014) and in this regard, well-capitalized financial institutions could absorb temporary financial difficulties on the part of their borrowers better.

Secondly, capitalization could be associated with the degree of risk aversion; this is in line with the literature which emphasized a link between risk aversion and financial institutions' capital (Rochet, 1992; Michelangeli & Sette, 2016). Financial institutions with lower risk aversion select ex ante a loan portfolio with higher return and risk and consequently, their borrowers are likely to become more financially fragile and thus more exposed to economic downturns. These concerns raise an important empirical question: Does MFI lending respond differently to economic activity depending on the level of capitalization? Since studies on lending cyclicality and capital–lending nexus in MFIs as well as the moderating role of capital in the relationship between MFI credit growth and GDP growth are missing, such studies could provide new empirical evidence on the need for a counter-cyclical capital buffer requirement in the microfinance industry.

2.2.2.2 Catching-up effect theory

The catch-up effect or theory of convergence, which is predicated in part on the law of diminishing marginal returns, explains that poorer economies tend to grow more rapidly than wealthier economies and therefore all economies will converge in terms of per capita income over time[12]. The finding by Igan and Pinheiro (2011) confirm this relationship; they found a negative relationship between credit growth and per capita income suggesting that financial institutions in richer countries have lower credit growth than financial institutions in poorer countries. In their study of "Credit growth in central and eastern Europe: Trend, Cycle or Boom", Kiss et al. (2006) also found that the credit growth in new member states is largely explained by the catching-up process. Hence, in this study, we also examined whether the level of institutional and economic development of a country impacts the credit growth of MFIs in SSA.

2.2.2.3 Other macro-economic determinants

One of the macro-economic variables that influence loan supply is GDP growth and GDP per capita (catch-up effect), discussed earlier. The other macro-economic factors are inflation and employment. Like GDP growth, employment and inflation have positive association with demand for loan. These positive relationships with demand for loans could contribute to the positive associations of inflation (Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004; Laidroo, 2012; Thibaut & Mathias, 2014) and employment (Bernanke & Lown, 1991) with the credit growth of financial institutions. In addition to capturing the demand for loanable funds, inflation could also mechanically drive credit growth given that credit growth is a nominal variable. Hence, this study also

[12] https://www.investopedia.com

explored whether demand factors (captured by macroeconomic factors) matter in the lending behavior of MFIs.

2.2.3 Industry related factors and credit growth

Due to the diversity of the nature of MFIs in social and commercial orientation and varying levels of agency costs of MFIs as the principal differs from donors to investors, legal status could be an important factor in the financial performance of MFIs within SSA. In this regard, the agency cost hypothesis implies that differences in ownership structure in firms could determine the magnitude of agency problem in these financial institutions (Fama & Jensen, 1983; Jensen & Meckling, 1976); consequently, the performance of MFIs could also depend on the legal status of the MFI.

In the microfinance industry where MFIs are organized mainly as Micro-Banks, NBFIs, Credit Union/Cooperatives or NGOs, managers of different MFIs have different incentives; hence, agency costs could vary depending on the charter type of the microfinance institution. NGO MFIs are heavily dependent on donations and lack a defined ownership. Consequently, Mersland and Strøm (2008) argue that agency costs could be higher in NGOs than Micro-Banks or NBFIs since the lack of owners with monetary incentives leads to inadequate monitoring of investments.

Conversely, Micro-Banks and NBFIs fund their assets using both equity and debt and consequently, shareholders and creditors will monitor and/or pressure the board in order to increase financial performance of the MFIs thereby reducing agency costs. In credit unions, managements are often voluntary (Ledgerwood, 2013); this could help to mitigate

principal–agent conflicts of interest as well as lower operating costs. Nevertheless, whether legal status matters in the credit growth of MFIs is an empirical question. Since MFIs with NGO charter type are not allowed to mobilize voluntary deposits in certain economies, this may limit the magnitude of their loanable funds which could negatively impact their ability to expand credits.

Regulation could also matter in the lending behavior of financial institutions. Although it is hard to determine whether regulators are excessively tough, some bankers have blamed the lending slowdown during the 1990–91 recession on overzealous regulation, particularly more aggressive examination practices that have allegedly forced banks to make excessive charges against current capital and to accept new credit risks more cautiously (Bernanke & Lown, 1991). Bernanke and Lown argue that even when it is true that bank examiners have recently gone from being too lax to being actuarially fair, so that excessive toughness is not an issue, such a change in standards would be desirable overall but would nevertheless have the effect of reducing loan supply.

However, to the extent that the influence of regulation is through loan loss provisions and the depletion of capital, the fundamental factor seems to be capital (Ibid). Nevertheless, in the microfinance industry where some MFIs are regulated and others are not regulated, regulation dummy variable could capture additional important information, for example, on reserve requirement which could affect loan supply by reducing loanable funds, which possibly could not be captured by capital. Therefore, our model also controls for regulation status of MFIs.

2.2.4 Persistency of credit growth

Kaplan and Aslan (2006) state that when competition is intense, there is likely to be little persistency. MFIs with above average credit growth in one period will not be able to maintain the same level of credit growth in the subsequent periods, as it will be eroded by competitors and hence, credit growth of competing MFIs will not be persistent. Conversely, if competition is less intense, credit growth differences between MFIs may be expected to be persistent. MFIs with above average credit growth will be able to maintain the same level of credit growth in the subsequent periods implying the presence of persistence of credit growth.

In this regard, Carlson, Correia, and Luck (2018) documented that incumbent banks operating in more competitive markets increase their loans and deposits portfolio at a rate 22 percentage points higher than their peers in less competitive markets implying banks with more market power limit credit provision. In their study of "Microfinance Profitability", Muriu (2011) revealed some moderate persistence in profitability of MFIs in Africa. They reported a coefficient of about 0.3 for the lagged profitability which implies that when there is a shock to profitability at time *t-1*, around 30 percent of the effect will continue into the following year. This evidence could indicate the existence of market power (Goddard & Wilson, 2009 cited in Muriu, 2011) or the existence of persistency of productivity (Kaplan & Aslan, 2006) in the microfinance industry.

Similarly, persistency in credit growth could exist due to the persistency of market power and/or the persistency of productivity in the credit market of the microfinance industry in Africa. Consequently, we have investigated the existence of persistency in the credit

growth of MFIs in SSA as well as the speed of convergence to the equilibrium credit growth.

2.3 Conclusions

Our review of the literature reveals that while prior studies provide useful insights mainly on the effects of capitalization, portfolio risk and/or business cycle on bank lending, empirical evidences on lending behavior from the microfinance industry are virtually missing. In this respect, the only closely related study is by Wagner and Winkler (2012) who examined whether the global financial crisis affected credit growth of MFIs and whether the impact varies depending on MFIs' legal status and the region they are located in. While this study does not focus on MFIs in SSA, it also fails to address whether and how MFIs' capitalization predicts lending behavior. The study did not also examine whether the lending behavior of MFIs is resilient to GDP shocks as well as whether the response of MFIs' lending behavior to GDP shocks depends on the level of capitalization.

Wagner and Winkler (2012) did not also incorporate other predictor variables such as profitability, liquidity, size of MFIs, and scale effects, among others, in their credit growth model and all these limitations could make the validity of their findings questionable as the omission of the aforementioned variables are likely to cause bias in parameter estimates and/or make the hypotheses testing invalid. This study also examined the persistence and speed of convergence to equilibrium of MFIs' lending.

Furthermore, while the prior empirical research used different approaches in modeling the capital–lending nexus, studies that build on the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework and examine whether capital impacts lending through the divergence between the actual level of capital and the desired level of capital (i.e the implicit target) are missing.

Empirical research which examined whether the capital-asset ratio impacts lending directly through the book capital ratio (Bernanke & Lown, 1991; Berrospide & Edge, 2010; Laidroo, 2012; Gambacorta & Shin, 2018) is criticized as the minimum capital requirement is not taken into account. Likewise, the prior studies that took into account regulatory capital requirements (Bolton & Freixas, 2001; Thakor, 1996; Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004; Covas, 2016) are also criticized for these papers have failed to consider the bank's own target capital. Hence, empirical research is needed to examine the effect of capitalization on lending through the divergence between the actual level of capital ratio and the implicit target capital ratio (Berrospide & Edge, 2010; Thibaut & Mathias, 2014[13]).

In addition, the prior studies also paid attention mostly to the effects of capitalization while evidences on the macroeconomic consequences of capital requirements are scant. Although several empirical evidences establish that lending behavior is pro-cyclical (Bikker & Hu, 2002; Gambacorta & Mistrulli, 2003, 2004; Quagliariello, 2007; Berrospide & Edge, 2010; Laidroo, 2012), the loan supply of financial institutions could also respond differently to the business cycle depending on the level of capitalization

[13] This study was made at a macro level

(Gambacorta & Mistrulli, 2003, 2004). Therefore, this study is pioneering in studying the lending behavior of MFIs in SSA with particular focus on the relationship between lending behavior and capital adjustment process in MFIs.

CHAPTER 3: THE DRIVERS OF LENDING BEHAVIOR: PRIOR EMPIRICAL EVIDENCES

3.1 Introduction

Poverty alleviation is the first core goal of sustainable development goals (SDGs). In this regard, although Sub-Saharan Africa (SSA) has healthy economic prospects, it has the highest share of poor people, with half of the population living below poverty line (CGAP & World Bank, 2010 cited in CGAP, 2012). While microcredit/microfinance is a much favored intervention for poverty alleviation in developing countries (Kyereboah-Coleman, 2007; Krauss & Walter, 2009; Ahmed, 2009), there is surprisingly little evidence of the drivers of the lending behavior of microfinance institutions.

Loans are important sources of funds for individuals, households and firms. Financial institutions' lending behavior is also a determinant of financial crises. MFI lending behavior also plays a critical role in the financial sustainability of MFIs ((Muriu, 2011; Tehulu, 2013) and poverty alleviation endeavor (Imai et al, 2012). Nevertheless, the Gross Loan Portfolio (GLP) of MFIs in SSA was the lowest in contrast with the other regions; we also observe significant variability in GLP among the MFIs (See Table 1 in Chapter 1). In Table 1, we also reported that the MFIs in SSA were also highly capitalized (with mean capital ratio of 34.31%) with significant variation in the level of capitalization (with δ=22.25%, minimum of 3.6% and maximum of 95.41%). These raises two important concerns: (1) what are the drivers of the lending behavior of MFIs in SSA? And (2) Does the level of capitalization count for credit growth of MFIs in SSA?

Specifically, this study aimed to address two critical issues. The first is what drives the lending behavior of MFIs in SSA. In this regard, we examined the effects on lending behavior of firm specific and macroeconomic factors controlling for industry related factors and the location of MFIs. The second is whether and how MFI capital impacts lending. Accordingly, building on the Bernanke and Lown (1991) and the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework applied in the banking industry, we investigated whether MFI capital impacts lending directly and/or through the divergence between the actual level of capital and the implicit target capital, respectively.

Although several studies examined the drivers of lending behavior using empirical evidence from the banking industry in the United States (Berrospide & Edge, 2010; Karmakar & Mok, 2013), in Italy (Gambacorta & Mistrulli, 2004; Cucinelli, 2016; Michelangeli & Sette, 2016), in European Countries (Laidroo, 2012; Thibaut & Mathias, 2014), in 90 countries worldwide (Igan & Pinheiro, 2011), in the eleven G10 countries plus those of Austria, Australia and Spain (Gambacorta & Shin, 2018) and in Nigeria (Olokoyo, 2011), whether the empirical results in these studies also hold true in the microfinance industry is an empirical question. It is against this background that this study aimed at addressing the aforementioned objectives. Accordingly, in this chapter, relying on the literature from the banking industry, we discuss the prior empirical evidences on what drives lending behavior.

3.2 Determinants of Lending Behavior

In the existing empirical literature, several studies examined lending behavior as a function of supply and demand factors. The supply factors mainly refer to the firm-specific factors which influence the supply of loans by affecting the availability of MFI/bank loanable funds and/or the decision of how much to lend. Demand factors are those variables which capture changes in demand for loanable funds; the literature uses macroeconomic factors to account for such changes. The firm-specific factors are those which could be influenced by management decisions or within the control of firm management. These factors include capitalization, portfolio risk, loan loss provisions, profitability, liquidity, firm size, deposit funding and non-deposit funding. The macroeconomic determinants of lending behavior include GDP growth, inflation, employment and GDP per capita.

3.2.1 Firm-specific determinants

The literature identifies capitalization as one of the supply-side determinants of loan supply. Several empirical studies on capital–lending nexus establish that capital matters in credit decision of financial institutions consistent with the capital crunch hypothesis (Gambacorta & Mistrulli, 2004; Berrospide & Edge, 2010; Thibaut & Mathias, 2014; Covas, 2016; Gambacorta & Shin, 2018). The capital crunch hypothesis suggests that higher capitalization could allow financial institutions to increase loans by increasing asset size while financial institutions with poor capitalization limit their lending in order to fulfill capital requirement; implying that loan supply is positively related to capitalization.

Using a state-level data, book value capital-to-asset ratio and a simple cross-sectional regression of loan growth on bank capital, Bernanke and Lown (1991) confirm that there is a causal link between low capital-asset ratios and low lending growth in the subsequent period, which is in support of the capital crunch hypothesis. Gambacorta and Mistrulli (2004) underline that if equity is low and it is too costly to issue new shares, financial institutions could reduce lending in order to meet regulatory capital requirements. Conversely, financial institutions with capital surplus could be able to increase lending since their capitalization is less likely to be short of the minimum capital requirement.

Gambacorta and Shin (2018) also used book value capital-to-asset ratio as a measure of capitalization and their findings also support the capital crunch hypothesis. However, Covas (2016) argues that the positive association of capitalization with credit growth documented by Gambacorta and Shin hinges on the positive relationship between lending and capital surplus. Covas uncovered that while a 1 percentage point increase in the capital surplus causes a 0.9 percentage point increase in annual loan growth, a 1 percentage point increase in the capital requirement leads to a 0.7 percentage point decrease in credit growth, implying that the level of capital relative to regulatory requirements is relevant in predicting future lending.

Similarly, the finding by Hessou and Lai (2018) show that there is a positive relation between credit union capitalization (i.e. buffer capital) at a point in time and its ability to extend loan in the next period, which is consistent with Covas (2016). Since the latter framework considers only regulatory requirements, to account for capital required by

market forces, prior studies have also examined the effect of capitalization on lending through the divergence between the actual level of capital ratio and the implicit target capital ratio called the deviation (Berrospide & Edge, 2010; Thibaut & Mathias, 2014).

Thibaut and Mathias (2014) argue that even when regulatory capital requirements are not binding, it does not mean that financial institutions are not capital constrained at all; market forces could also matter. The level of capitalization is a good indicator of bank/MFI solvency; this implies that adequate capitalization is essential to meet not only capital requirements but also market constraints; Thibaut and Mathias state that the stigma generated by the former could intensify the pressure by the latter. The findings in Berrospide and Edge (2010) and Thibaut and Mathias (2014) support the positive association of capitalization (as measured by the deviation) with lending.

Since the capital-asset ratio may predict future lending only because it contains information about future economic activity, a more stringent test of the capital crunch hypothesis requires adding a measure of contemporaneous economic activity to the right side of the lending equation to test whether it absorbs the predictive power of the capital-asset ratio (Bernanke & Lown, 1991). The findings by Bernanke and Lown (1991) confirm that the inclusion of employment growth, a measure of economic activity, does not weaken the effect of capital-to-asset ratio on subsequent lending; this provides further evidence in support of the capital crunch hypothesis and against the hypothesis that the capital-asset ratio predicts lending only because it is informative about future economic activity.

On the other hand, the literature also shows that capitalization may be associated with financial institution risk aversion; this is in line with the literature which emphasized a link between risk aversion and financial institutions' capital (Rochet, 1992; Michelangeli & Sette, 2016). Accordingly, the findings by Cucinelli (2016) show that banks with a higher level of equity to total assets reduce lending; this could imply that the higher bank capital, the greater are the incentives for equity holders to reduce the riskiness of assets which thereby limits bank lending activity. To the contrary, Michelangeli and Sette (2016) found that higher bank capital is associated with a higher likelihood of application acceptance and lower offered interest rates; banks with lower capital reject applications by riskier borrowers and offer lower rates to safer ones. These results suggest that the direction of relationship between loan supply and capitalization also depends on the link between bank/MFI risk aversion and the level of capitalization.

In addition, the prior studies revealed that the magnitude of the effect of capital on lending varies over time and is asymmetric. Carlson et al. (2013) examined the impact of bank capital ratios on bank lending. Based on data from 2001 to 2011, they find that the relationship between banking lending and capital ratios was significant during and shortly following the recent financial crisis but not at other times. They also find that the elasticity of bank lending with respect to capital ratios is higher when capital ratios are relatively low, suggesting that the effect of capital ratio on bank lending is nonlinear.

Similarly, Thibaut and Mathias (2014) conclude that the relationship between lending and capitalization is mainly driven by undercapitalized banking system. While the growth rate of aggregate lending tends to decrease significantly in countries/periods where banks are

below their target, the authors do not observe such a pattern during episodes of aggregate over-capitalizations. They argue that the effect of capitalization on loan growth for over-capitalized banks could be less marked since "banks cannot force agents to borrow while they can prevent them from getting funds: the extent of the increase in lending is possibly more sensitive to changes in the demand than the supply of credit" (P.16).

Prior empirical research has also examined the moderating effect of size on the relationship between lending behavior and capitalization; however, results are not consistent. Based on data from individual banks in New Jersey during the period 1989–91, Bernanke and Lown (1991) compare the reaction to capital shocks of lending by different groups of banks (specifically, small and large banks) and conclude that the capital-asset ratios and lending are strongly linked for small banks than for large banks. Using regulatory capital (i.e. capital adequacy ratio) as a measure of capitalization, Karmakar and Mok (2013) found a moderate response of lending to bank capital. However, the effect is bigger for the relatively bigger banks which contradicts with the finding of Bernanke and Lown (1991).

Another factor that could matter in the credit supply of financial institutions is portfolio quality. A deterioration of portfolio quality could affect subsequent lending behavior. While most models predict/show a positive relation running from credit growth to portfolio risk (Dell'Ariccia & Marquez, 2006; Borio, 2014; Cucinelli, 2016), several evidences show that a deterioration in portfolio quality impacts credit growth negatively (Berrospide & Edge, 2010; Wagner & Winkler, 2012; Tomak, 2013; Karmakar & Mok, 2013; Cucinelli, 2016). Berrospide and Edge (2010) examined the effect of bank capital

on lending in the United States. They found that out of the 2.9 percentage point decline in the quarterly loan growth rate from 2008:Q4 to 2009:Q3, of which the model explains 2.2 percentage points, 1.1 percentage points is explained by changes in net charge-offs rates, which captures the deterioration in loan quality.

In studying the impact of the global financial crisis on credit growth of MFIs, Wagner and Winkler (2012) also found that portfolio risk negatively affects MFI's real credit growth. They state that a rise in portfolio risk makes MFIs less willing to expand credits in the subsequent year. Similarly, Panetta (2013) emphasizes that uncertain economic prospects and the difficulty of assessing the soundness of each debtor cause adverse selection and high default risk and aversion to rising risk among banks, which then led to policies on lending restrictions (Cucinelli, 2016).

Using evidence from banks in Italy, Cucinelli (2016) also analyzes lending behavior before and during the most recent financial crisis and found similar results; an increase in the bank credit risk is associated with a reduction in the bank lending behavior; in particular, the variable with a higher impact is the loan loss provisions ratio. Their finding revealed higher impact on the bank lending behavior with regard to the loan loss provisions ratio and lower in the growth of non-performing ratio. Laidroo (2012) also assert that loan impairment charges capture the effect of credit risk more accurately in comparison to measures based on loan loss reserves since the former is a more timely measure of credit risk than the latter measures.

While empirical findings on the relationship between lending and profitability are scant, the existing few studies show that there is a positive link between lending and profitability (Igan & Pinheiro, 2011; Laidroo, 2012; Hessou & Lai, 2018). Igan and Pinheiro (2011) uncovered that loan growth is positively related to profitability (as measured by net interest margin) implying that higher profitability allows financial institutions to grow faster. This result is consistent with the finding of Laidroo (2012) who confirms that higher profitability of lending (as measured by net interest income to average total assets) is associated with an increase in lending. However, Laidroo (2012) found that alternative profitability measures (operating profit (*ROA)* and return on equity (*ROE))* remain statistically insignificant. Laidroo (2012) concludes that the profitability of lending operations remains an important determinant of lending growth in comparison to the overall profitability of bank's operations.

Hessou and Lai (2018), however, show that profitability as measured by return on assets (ROA) at time *t-1* is followed by subsequent more loan granting. Hessou and Lai explain this positive relationship as follows: In MFIs which are particulary mutually owned ones such as credit unions, dividends paid to members store up in saving accounts and available for granting new loans. They also argue that credit unions also adjust capital buffers by retaining earnings; this could lead to the positive relationship between lending and profitability.

On the other hand, the literature on the effect of liquidity on lending behavior is mixed. While some of the existing studies document a positive relationship (Gambacorta & Mistrulli, 2003; Berrospide & Edge, 2010; Laidroo, 2012; Hessou & Lai, 2018),

Cucinelli (2016) reported a negative relationship. In this connection, in their study of "Bank capital and lending behavior", using empirical evidence from Italy, Gambacorta and Mistrulli (2003) confirm that liquidity affects lending positively, which is in line with Gambacorta (2001). This implies that financial institutions with a higher liquidity ratio could use their stock of liquid assets and be better able to shield their lending activity (Kashyap & Stein, 2000; and Ehrmann et al., 2003; cited in Gambacorta & Mistrulli, 2003) against shocks to the availability of external finance. Hessou and Lai (2018) also reported that liquidity is positively associated with changes in loans-to-assets suggesting that credit unions with more liquidity in a particular year are likely to extend more loans in the following year.

The contrasting finding in Cucinelli (2016) could be explained by considering how they measured liquidity; they use total securities to total asset ratio as proxy for liquidity, which, however, captures investment activities other than lending rather than liquidity. Loans and securities comprise the two major assets of banks/MFIs. Consequently, depending on investment choices, liquidity (as measured by securities to total assets) could have negative or positive effect. In this regard, Berrospide and Edge (2010) establish that liquidity has a positive effect on loan growth: An increase in the securities-to-assets ratio by 1 percentage point leads to about a 0.3 percentage point long-run increase in annualized loan growth; this contradicts with the finding of Cucinelli (2016). It implies that when the preferred asset category is the loan, financial institutions could sell their securities to meet their funding needs for making new loans. Nonetheless, the empirical evidence by Olokoyo (2011) shows liquidity has an insignificant effect on lending behavior.

Similarly, the relationship between credit growth and firm size is inconclusive (Aydin, 2008; Matousek & Sarantis, 2009; Wagner & Winkler, 2012; Laidroo, 2012; Thibaut & Mathias, 2014). Thibaut & Mathias (2014) found that the relationship between bank lending and size is not conclusive: Depending on the nature of the loans in terms of sectors (MFI vs. non-MFI[14]) and counterparties (domestic Vs non-domestic), the effect of the size of the banking sector is either negative or positive. In the same way, while Aydin (2008) reported a positive association of size of financial institutions with credit supply, the finding by Laidroo (2012) revealed that loan growth is negatively related to size which is opposite to their a priori expectation. Laidroo states that this may be due to very low base value of smaller banks compared to large banks. Hence, controlling for scale effects is essential in modeling lending behavior. On the other hand, Wagner and Winkler (2012) found insignificant effect of size on credit growth of MFIs mainly due to inappropriate proxy for size[15]. Their study does not also control for scale effects.

Deposits (Olokoyo, 2011; Laidroo, 2012; Cucinelli, 2016) and non-deposit borrowings (Wagner & Winkler, 2012) are also important covariates to influence the lending behavior of financial institutions. Deposits and non-deposit borrowings could influence the lending behavior of financial institutions by influencing the availability of loanable funds. In this respect, Laidroo (2012) confirms that deposits have positive effect on bank lending growth. Similarly, while Olokoyo (2011), using empirical evidence from the banking industry in Nigeria, show that the volume of deposit has the highest impact on

[14] Loans to non-MFI, whether domestic or non-domestic, include loans to households, corporate sector and governments.
[15] Wagner and Winkler (2012) measure size using loan portfolio (in USD) of the respective MFI to GDP of the respective country (in USD).

the lending behavior of commercial banks, Wagner and Winkler (2012) establish that non-deposit funding also has a positive and statistically significant effect on credit growth of MFIs. However, Wagner & Winkler reported that the result has small economic significance: “Funding growth rates have to be in the range of 100% in order to be associated with a rise of credit growth by about 5 percentage points” (P.10).

Under normal circumstances, the growth of deposits influences the loan growth rate positively since for most of the commercial banks, deposits represent the main sources of loanable funds (Hou & Dickinson, 2007 and Tracy, 2011 cited in Cucinelli, 2016). However, Laidroo (2012) claims that banks with greater deposit holdings are more likely to be affected by bank runs. They argue that since short-term funding increases the vulnerability of banks to economic conditions and is more likely to affect banks during crisis periods; this could lead to a negative association with lending growth. This view supports Wagner and Winkler (2012) who found that MFIs securing more funding in the previous year exhibit significantly lower credit growth during the crisis. Cucinelli (2016) also reported that the coefficient associated with the growth of customer deposits is ambiguous – sometimes, it is positive and, other times, it is negative, contrary to expectations. They state that, during a recession period, banks prefer to use deposits for other less risky activities, other than loans.

3.2.2 Macroeconomic factors

The macroeconomic variables capture the effect of demand-side determinants of loan growth as financial institution’s performance is sensitive to prevailing macroeconomic

conditions. The literature[16] employs GDP growth, inflation, unemployment and GDP per capita to capture the effects of changes in loan demand (Bernanke & Lown, 1991; Gambacorta & Mistrulli, 2004; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Wagner & Winkler, 2012; Tomak, 2013; and Thibaut & Mathias, 2014). In examining the effect of bank capital on lending, Berrospide and Edge (2010) test the response of BHC loan growth to demand shocks (measured by changes in GDP growth). They found that a 1 percentage point reduction in GDP growth leads to about a 4 percentage point decline in annualized loan growth; the result also shows that out of the 2.9 percentage point decline in the quarterly loan growth rate of BHCs in the United States from 2008:Q4 to 2009:Q3, of which the model explains 2.2 percentage points, 1.3 percentage points is accounted for by changes in GDP growth.

Igan and Pinheiro (2011) also show that real GDP growth has a statistically significant positive impact on credit growth. Igan & Pinheiro (2011) state that, during upturns, favorable investment opportunities and strong economic activity push asset prices up, which in turn improve the creditworthiness of borrowers and allow them to borrow more against higher values of collateral. During downturns, borrowers' financial situation deteriorates, customers become pessimistic and asset prices fall causing decrease in value of collaterals (Laidroo, 2012) which results in increased defaults and tightening of credit standards.

Other similar findings include Laidroo (2012) who explore lending growth and cyclicality in Central and Eastern European Banks and uncover that GDP growth has a

[16] These studies used one or more of these macroeconomic variables to control for loan demand.

positive association with lending growth and Thibaut and Mathias (2014) who, in their study of "Bank capital adjustment process and aggregate lending", reported that GDP growth and inflation significantly and consistently influence aggregate lending positively: the higher the economic growth and the larger the changes in prices level, the higher the credit growth.

The literature also reveals that GDP growth has asymmetric effect on lending behavior. Using an econometric specification based on Kashyap and Stein (1995), Gambacorta and Mistrulli (2003) test whether banks with a different degree of capitalization react differently to a GDP shock in terms of lending behavior. Their findings revealed that capitalization influences the way banks react to GDP shocks in that the credit supply of well-capitalized banks is less pro-cyclical. This means that since well-capitalized banks are more risk averse, they suffer less loan losses and their capital changes less with respect to other banks when an economic downturn occurs (Gambacorta & Mistrulli, 2004). However, Michelangeli and Sette (2016) uncovered that higher bank capital is associated with a higher likelihood of application acceptance and lower offered interest rates; banks with lower capital reject applications by riskier borrowers and offer lower rates to safer ones; this implies that loan supply of well-capitalized banks could also be more pro-cyclical.

As to inflation, since it has a positive association with loan demand, it could influence the credit growth of financial institutions positively. Apart from capturing the demand for loanable funds, inflation could also mechanically drive credit growth given that credit growth is a nominal variable. However, the prior studies reveal mixed evidences; while

Gambacorta and Mistrulli (2003; 2004); Laidroo (2012) and Thibaut and Mathias (2014) uncovered a positive association and Cucinelli (2016) revealed a negative relationship, Berrospide and Edge (2010) found that inflation has no significant effect on loan supply. As to the effect of employment and level of institutional and economic development, the findings by Bernanke and Lown (1991) confirm that there is a strong positive link between loan growth and employment growth while Igan and Pinheiro (2011) revealed that catching-up, reflected in faster credit growth in poorer countries, is also important in explaining lending behavior: GDP per capita has a negative coefficient in all periods.

3.2.3 Other determinants

The microfinance industry is diverse in ownership structure where MFIs are organized mainly as Micro-Banks, NBFIs, Credit Union/Cooperatives or NGOs. Accordingly, managers of different MFIs have different incentives and hence, agency costs could vary depending on the charter type of the microfinance institution. Consequently, the performance of MFIs could also depend on the legal status of the MFI. In this regard, the literature shows mixed empirical evidences as to the effect of legal status on MFI performance.

While Hartarska and Nadolnyak (2007), Mersland and Strøm (2008), and Mersland and Strøm (2009) show no significant difference in the performance between NGOs and private microfinance companies, Fernando (2004) confirms that legal status matters for the performance of MFIs. By examining 39 cases of transformation, Fernando (2004) revealed that most transformation from non-profit making microfinance organizations

(NGOs) into regulated MFIs contributes to improved governance system and financial performance.

In this respect of the above, Ledgerwood and White (2006) also argue that NGOs have less effective governance system than banks and NBFIs as they lack real owners and are concerned with achieving social rather than financial objectives; this contributes to weaker financial performance. In contrast, Gutiérrez-Nieto et al. (2007) revealed lower operating costs in NGOs since volunteers constitute the majority of their employees. Using both univariate and multivariate analysis techniques and a dataset of 57 MFIs in India, Ghose, Paliar, and Mena (2018) also uncovered that NGOs have better financial and sustainability performance compared to non-banking financial companies (NBFCs) but both are indistinguishable with regard to social performance. They also found that the former MFIs have better portfolio quality and lesser costs of operation than the latter and conclude that NGOs outperform NBFCs in all dimensions of financial performance except for social performance where both have the same performance suggesting that the transformation of NGOs to NBFCs may not improve the performance of Indian MFIs.

Similarly, using a sample of 119 NGOs, Callen, Klein, and Tinkelman (2003) conclude that "… the presence of major donors in the board of directors enhances the effectiveness and the efficiency of NGOs" (as cited in Tchakoute-Tchuigoua, 2010:437), which implies that NGOs could have at least the same performance as other legal form MFIs (Ibid). Hartarska and Nadolnyak (2007) also found that regulatory involvement has little direct effect on performance either in terms of outreach or operational self-sustainability implying that the transformation of MFIs into regulated financial institutions may not

contribute to improved financial performance and outreach. Nevertheless, the authors point out that since MFIs' savings mobilization allows reaching more borrowers, regulation may have indirect benefits provided that regulation is the only option for MFIs to access public deposits.

Using data from 2001 to 2003, Lafourcade, Isern, Mwangi, and Brown (2005) also examine whether African MFIs' performance varies by sub-region and MFI type. The study revealed that the financial structure of MFIs varies across MFI type within Africa. Unregulated MFIs rely more heavily on equity financing than regulated ones; NGOs and unregulated MFIs are poorly leveraged because they are not allowed to mobilize public deposits in certain economies. Additionally, Lafourcade et al. uncovered that unregulated MFIs report higher portfolio quality with a PAR >30 days of 3.4 percent than regulated MFIs with a PAR > 30 days of 4.3 percent, weighted by GLP, while MFIs in Africa generally have high portfolio quality.

In contrast, Tchakoute-Tchuigoua (2010) studied the effect of legal status on the performance of MFIs using 202 MFIs over the period 2001 to 2006. They show a significant difference in performance (as measured by portfolio quality) across legal status; in particular, they found that commercial MFIs do better than NGOs. They also document no significant difference in profitability between NGOs and private microfinance companies; whereas, Lafourcade et al. (2005) found that regulated MFIs are more profitable than non-regulated MFIs. Regarding the impact of legal status on credit growth, Wagner and Winkler (2012) revealed that during the global financial crisis the decrease in credit growth is less significant in non-profit institutions than in for-profit

MFIs, which implies that commercialization of microfinance impacts the stability of microcredit negatively.

Due to heterogeneities in economic, social and legal conditions among countries in Sub-Saharan Africa, location of the MFIs could also impact the financial performance of MFIs within SSA. In this respect, Lafourcade et al. (2005) document that MFIs in Africa tend to report lower levels of profitability (as measured by ROA) than MFIs in other global regions. In addition, they show that MFI profitability varies across African regions; while East Africa MFIs are the most profitable and those in West Africa also generate positive returns, MFIs in the Central Africa and Southern Africa regions generate negative returns.

However, Lafourcade et al. revealed that the financial structure of MFIs does not vary significantly across regions within Africa. The study further show that African MFIs finance only 25 percent of assets with equity while MFIs globally (except in the LAC region) heavily depend on donations and retained earnings. They also document that deposits are the main source of funding for African MFIs; nevertheless, the use of non-deposit borrowings for African MFI funding is limited. In contrast, in their study of "Microfinance profitability", Muriu (2011) establish that location is not a significant factor in explaining MFI profitability. However, to the extent other predictor variables included in the regression model in this study capture the effect of location, location may fail to be a significant determinant of MFI performance. Finally, we provide a brief summary of empirical evidences on the factors that influence lending behavior in the table (Table 2) below.

Table 2: *A summary of Empirical Evidences on Lending Behavior*

Independent Variables		*Dependent Variable: Lending*	
		Author(s)	*Result*
Firm Specific Factors:	*Lagged Dependent*	Berrospide & Edge (2010); Igan & Pinheiro (2011); Olokoyo (2011); Laidroo (2012); Thibaut & Mathias (2014)	*+ve*
		Igan & Pinheiro, (2011); Thibaut & Mathias (2014); Cucinelli (2016)	*Insignificant*
	Capitalization	Bernanke & Lown (1991); Hancock & Wilcox (1993); Hancock & Wilcox (1994); Gambacorta & Mistrulli (2003); Gambacorta & Mistrulli (2004); Berrospide & Edge (2010); Laidroo (2012); Karmakar & Mok (2013); Carlson et al. (2013); Thibaut & Mathias (2014); (Gambacorta & Shin, 2018)	*+ve*
		Cucinelli (2016)	*-ve*
		Bernanke & Lown (1991); Carlson et al. (2013); Thibaut & Mathias (2014)	*Insignificant*
	Profitability	Igan & Pinheiro (2011); Laidroo (2012)	*+ve*
	Deposits	Olokoyo (2011); Laidroo (2012); Cucinelli (2016)	*+ve*
		Cucinelli (2016)	*-ve*
	Portfolio risk	Hancock & Wilcox (1993); Hancock & Wilcox (1994); Berrospide & Edge (2010); Karmakar & Mok (2013); Cucinelli (2016)	*-ve*
		Hancock & Wilcox (1993); Hancock & Wilcox (1994)	*Insignificant*
	Loan loss provisions	Laidroo (2012); Cucinelli (2016)	*-ve*
	Size	Thibaut & Mathias (2014)	*+ve*
		Laidroo (2012); Thibaut & Mathias (2014)	*-ve*
	Liquidity	Gambacorta & Mistrulli (2003); Berrospide & Edge (2010); Laidroo (2012); Karmakar & Mok (2013)	*+ve*
		Cucinelli (2016)	*-ve*
		Olokoyo (2011)	*Insignificant*

Macro-economic Factors:	*GDP Growth*	Hancock & Wilcox (1993); Bikker and Hu (2002); Gambacorta & Mistrulli (2003); Gambacorta & Mistrulli (2004); Berrospide & Edge (2010); Igan & Pinheiro, (2011); Olokoyo (2011); Laidroo (2012); Thibaut & Mathias (2014); Cucinelli (2016)	*+ve*
		Karmakar & Mok (2013)	*-ve*
		Thibaut & Mathias (2014); Cucinelli (2016)	*Insignificant*
	Inflation	Bikker & Hu (2002); Gambacorta & Mistrulli (2003); Gambacorta & Mistrulli (2004); Laidroo (2012)	+
		Cucinelli (2016)	-
		Berrospide & Edge (2010)	*Insignificant*
	Unemployment	Bernanke & Lown (1991); Bikker & Hu (2002); Laidroo (2012); Cucinelli (2016)	*-ve*
		Hancock & Wilcox (1993); Hancock & Wilcox (1994)	*Insignificant*
	GDP per capita	Igan & Pinheiro (2011); Wagner & Winkler (2012)	*-ve*

3.3 Estimation Techniques Applied

Regarding the choice of an appropriate model, we noticed that different studies employed diverse data analysis techniques including dynamic panel data modeling (Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004; Cucinelli, 2016; Gambacorta & Shin, 2018), fixed effects instrumental variable estimation (Karmakar & Mok, 2013), fixed effect estimation (Wagner & Winkler, 2012; Thibaut & Mathias, 2014; Covas, 2016; Hessou & Lai, 2018) and OLS (Bernanke & Lown, 1991; Hancock & Wilcox, 1993) in studying the determinants of lending behavior.

In dynamic panel models, OLS estimator is biased upwards (Bond, 2002). Consequently, we could use fixed effect estimation in panel data with fixed effects when we have long time-series as the bias becomes insignificant. We could also use fixed effects

instrumental variable estimation in such cases if endogeneity problem is a concern. However, the dynamic panel data modeling is much richer in economic content allowing distinguishing short-run and long-run effects of predictor variables and also preferred when we have short panel in order to obtain unbiased estimates. Our dynamic panel data analysis technique "the system GMM" also allows estimating the effect of time invariant components as well. The Fixed Effects estimation technique could be biased given a short panel such as ours and cannot estimate the effects of time invariant components as it drops them from the regression equation.

3.4 Conclusions

Taking Chapter 2 and 3 together, our review of the literature shows that while several empirical studies are made on lending behavior based on empirical data from the banking industry, the results are inconsistent, sometimes contradictory and setting and time dependent. Although the prior studies provide useful insights mainly on the effects of capitalization, portfolio risk and/or business cycle on lending behavior in the banking industry, empirical evidences from the microfinance industry are virtually missing.

The microfinance sector is diverse in ownership structure where the MFIs are organized as micro-banks, NBFIs, NGOs, Credit Unions/Coop. or rural bank; with regulated or unregulated status and for profit or not for profit status. Managers of MFIs with different charter types have different incentives and degree of commercial orientations (Tehulu, 2020). Therefore, whether the empirical evidences from the banking industry also hold true for MFIs is an empirical question.

The microfinance industry in SSA is also highly capitalized (Tehulu, 2020). It is argued that the effect of capitalization on loan growth for over-capitalized financial institutions could be less marked since financial institutions cannot force clients to borrow while they can prevent them from obtaining credits (Thibaut & Mathias, 2014). Therefore, it is also interesting to investigate whether capitalization contributes to the credit growth of MFIs. In addition, while the long-held view is that MFI credits are more stable source of finance than bank credits (Wagner & Winkler, 2012), there are no empirical evidences whether the lending behavior of MFIs is resilient to economic shocks. This article is also the first paper that offers useful insights to central banks/regulatory authorities and the Basel Committee on the need for a counter cyclical capital buffer requirement in MFIs.

While prior empirical research used either the capital-to-asset ratio directly (Bernanke & Lown, 1991; Berrospide & Edge, 2010; Laidroo, 2012; Carlson et al., 2013; Cucinelli, 2016; Gambacorta & Shin, 2018) or the capital adequacy ratio/regulatory based capital surplus/shortfall (Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004; Karmakar & Mok, 2013; Carlson et al., 2013; Covas, 2016), studies that build on the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework and examine whether capital impacts lending through the divergence between the actual level of capital and the desired level of capital (i.e the implicit target) are also missing.

Furthermore, while the prior studies establish that lending behavior is not resilient to GDP shocks (Bikker & Hu, 2002; Gambacorta & Mistrulli, 2004; Quagliariello, 2007; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Laidroo, 2012), in part, since demand for loans is pro-cyclical, the effect of business cycle on loan supply of financial

institutions could be asymmetric depending on the level of capitalization (Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004). Nevertheless, the prior studies have paid little attention to the macroeconomic consequences of capital requirements.

This study also applied dynamic panel data modeling since it is much richer in economic content allowing distinguishing short-run and long-run effects of predictor variables and also preferred when we have short panel in order to obtain unbiased estimates. Our dynamic panel data analysis technique "the system GMM" also allows estimating the effect of time invariant components as well. The Fixed Effects estimation technique could be biased given a short panel such as ours and cannot estimate the effects of time invariant components as it drops them from the regression equation.

CHAPTER 4: DATA AND METHODOLOGY

4.1 Introduction

Methodology is the strategy or plan of action which lies behind the choice and use of particular methods (Crotty, 1998). More specifically, methodology is concerned with why, what, from where, when and how data is collected and analyzed (Scotland, 2012). In this study, we discuss the data and methodology used in identifying the drivers of MFI lending behavior. Accordingly, in subsequent sections, first we discuss the research scientific positioning and design to be followed in our study. Then, we discuss the nature and sources of data and the remaining sections describe samples and sampling, model specification, description and measurement of variables and hypotheses, estimation methodology and robustness tests made.

4.2 The Research Scientific Positioning and Design

Different studies inherently contain differing ontological and epistemological views; therefore, they have differing assumptions of reality and knowledge which underpin their particular research approach (Scotland, 2012). Consequently, researchers need to take a position (ontological and epistemological position) regarding the research paradigm they follow in their research. The ontological position relates to the nature of reality while epistemology explores the nature of knowledge and these philosophical positions determine the *methodology* which in turn establishes *methods* (Slevitch, 2011). The two viewpoints that arise from ontological position are *ontological realism*, that single, objective, and independent reality exists independent from a subject's individual perception, and *ontological constructivism*, that there are multiple realities that are mind-

dependent and cannot be described free from people's points of view, particular interests, values, and purposes (Ibid).

The epistemological position can be distinguished between the *positivist* and the *interpretivist* paradigm (Holten et al., 2005 and Becker & Niehaves, 2007 cited in Royer, 2013). The ontological position of positivism is realism (Slevitch, 2011). The realist position is the view that objects have an independent existence and are not dependent for it on the knower (Cohen, Manion & Morrison, 2007). Thus, a discoverable objective reality exists independently of the researcher. The positivist epistemology is objectivism; positivists go forth into the world impartially, discovering absolute knowledge about an objective reality (Scotland, 2012) using objective data and methods. The ontological position of interpretivism is relativism– the view that reality is subjective and differs from person to person (Guba & Lincoln, 1994). The interpretive epistemology is one of subjectivism: For the same phenomenon, different people may construct meaning in different ways (Crotty, 1998). Interpretive methodology is directed at understanding phenomenon from an individual's perspective (Creswell, 2009).

During the 20th century, post-positivism also emerged from positivism with similar ontological and epistemological beliefs as positivism (Scotland, 2012). It differs from positivism in several ways. Firstly, the truth produced by the scientific paradigm is simply our belief in the truth of current tested hypotheses and one should try to assess how far it has been able to prove its fitness to survive by standing up to tests (Popper, 2002). Secondly, the principle of falsification argues that scientific theories can never be proven true or false but instead can be described as more or less probable and that only

when all attempts to refute them fail can they tentatively be accepted and thus, "every scientific statement must remain tentative forever" (Popper, 2002, P.280). Positivists view their methodology as value neutral, thus the knowledge generated is value neutral; however, throughout the research process, researchers make value-laden judgments, for example, in selection of variables, choices of proxy, and interpretation of findings (Scotland, 2012).

This study aimed at examining the determinants of the lending behavior of MFIs with particular focus on the relationship between MFI lending behavior and their capital adjustment process. In this study we tested the plausibility of prior empirical evidences in the banking sector to MFIs in Sub-Saharan Africa. Given the nature of the problem and the objective of the study, we applied a causal research design and a quantitative data analysis approach to test the cause-effect relationships.

The above discussions clearly show that the scientific positioning of this research is ontological realism and epistemological post-positivism. From the review of the literature in chapter two and three, we can recognize that capital adjustment and lending decisions are not subjective and we believe that there is single, objective reality which supports ontological realism. The reality simply refers to the relationship we tried to discover. Moreover, the literature shows that credit and capital adjustment decisions are not made in a random manner reinforcing our view that there is a discoverable objective reality. It is also possible to uncover objective knowledge (systematic explanations) on the drivers of and relationship between lending behavior and capital adjustment decision using objective methods to collect and analyze data because the capital adjustment and lending

decisions are not mainly subjective and hence, support the epistemological post-positivism. We choose the post-positivism over the positivism since such studies involve value-laden judgments in variable selection and choice of proxies, among others, implying that our findings and explanations might not completely be value free.

4.3 The Data

The study employed panel data as it helps to track changes in variable values and relationships overtime (Hair, Black, Babin, Anderson & Tatham, 2006). The use of panel data also allows studying the effects of lags and both the values and the ordering of the data points have meaning (Wooldridge, 2006). It also allows for controlling unobserved characteristics of individual firms (MFIs). The study relied on data covering the period 2004 to 2014 since it is the period within which relevant data can be accessed. The time horizon is divided into three sub-periods: the years 2004–2007 (i.e. the pre-crisis period), the second period from 2008–2009 (i.e. the global financial crisis period) and the third period (2010–2014), post-crisis. One of the implicit assumptions in causal models is that the relationships are stable across different time periods, which is uninvestigated assumption. The classification of time periods into three different time periods, therefore, allows to make a time varying analysis to establish that the findings on the drivers of credit growth of MFIs are stable over time.

We eliminated MFIs that, over the pre-crisis period, had no gross loan portfolio data for the years 2005, 2006 and 2007 and, over the crisis period (i.e. had no gross loan portfolio data for the year 2008 and 2009) given that calculation of growth rates requires lag values

and a time-varying analysis also requires that we have adequate observation in each sub-period.

This study has relied on two credible data sources viz. the MIX Market and World Bank Development Indicators and, thus, allows considering firm specific, industry related and macroeconomic factors as potential predictor variables.

Institution-Level Data

In the dynamic panel regression, the study has employed data at the institution level. Following previous studies in the microfinance field (Ahlin et al, 2011; Cull, Demirgüc-Kunt & Morduch, 2011; Imai et al, 2012; D'Espallier, Hudon & Szafarz, 2013; Tchakoute Tchuigoua, 2016), institution level data to be used in this study come from the MIX[17] database. This dataset is available online at www.mixmarket.org.

Macroeconomic Data

The study has also used macroeconomic data which is obtained from World Bank website. These country level macroeconomic indicators are publicly available at http://data.worldbank.org/data-catalog/world-development-indicators. Prior studies that have employed this dataset include: Cull et al (2011); Muriu (2011); Ahlin et al (2011); and Imai et al (2012).

[17] The MIX database is a web-based microfinance platform that provides data on individual MFIs. To date, the MIX platform discloses information on the viability and financial and social performances of about 2000 microfinance institutions (Tchakoute Tchuigoua, 2016). These data are provided by the MFIs themselves and is supported by audited financial statements or rating reports, which are established by a third party before publication (Muriu, 2011).

4.4 Sample

Given the diversity of the nature of MFIs where MFIs are organized as banks, credit unions, non-governmental organizations (NGOs), or non-bank financial institutions, empirical analysis is difficult and calls for cross-country data to obtain adequate number of observations to control for such attributes. The use of cross-country data also helps to examine the effects of differences in location, regulation, other industry related factors, and macroeconomic developments on MFIs' capital adjustment and lending decisions as it provides more variability in the data values and hence, allows a flexible dynamics in the lending behavior and the capital adjustment process.

Accordingly, this study employs unbalanced panel dataset of 138 MFIs on 31 countries[18] in SSA. Although there are 48 countries in SSA according to the World Bank classification, the remaining countries either do not have MFIs or the MFIs do not submit data to the MIX Market (or data are incomplete). Our panel is unbalanced since not all MFIs have information for every year which is mainly due to missing values and other reasons could be new entry and exit by some MFIs.

[18] The lists of countries included in our analysis comprise Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the, Congo, Republic of the, Cote d'Ivoire (Ivory Coast), Ethiopia, Gambia, The, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda and Zambia.

4.5 Econometric Model Specifications

4.5.1 Modeling lending behavior: An application to MFIs

In this study, we modeled the lending behavior of MFIs as a function of supply and demand factors, with one of the supply factors being MFI capitalization. The study employed two ways of modeling the channel going from capital to lending. First, building on Bernanke and Lown (1991) framework, we tested whether the capital-to-asset ratio affects loan growth directly. This framework has subsequently been applied by Berrospide and Edge (2010); Carlson et al. (2013); and Gambacorta and Shin (2018). Second, in line with Berrospide and Edge (2010) and Thibaut and Mathias (2014), we applied the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework in which MFI capital impacts lending through the divergence between the actual level of capital and the desired level of capital. While our model is similar in spirit with Hancock and Wilcox (1993;1994), it is closer to and a variant of Berrospide and Edge (2010) and Thibaut and Mathias (2014).

In the second approach, following the work of Berrospide and Edge (2010) and Thibaut and Mathias (2014), the paper implemented a stepwise strategy. In a first step, the paper investigated the capital adjustment process in a *partial* adjustment framework which is rationalized by a cost–benefit analysis. Given adjustment cost, MFIs try to converge towards an implicit target while maximizing their profit. This paper, thus, estimated this MFI *implicit target* as well as the adjustment speed by using (i) a set of observables from MFI balance sheets, (ii) a macro-economic factor, and (iii) a set of MFI-specific time invariant components. In a second step, we compute for each MFI and for each period

what we called the *deviation (DEV)* from the estimated optimal target (i.e. the difference between the actual capital ratio and the long run target) and examine whether capitalization affects lending behavior through the deviation.

Specifically, the lending behavior ($LB_{i,c,t}$ measured as growth rate of GLP) econometric model that we estimated has the following form:

$$LB_{i,c,t} = \alpha_0 + \beta_1 LB_{i,c,t-1} + \sum_{j=1}^{8} \pi_j Zj_{i,c,t/t-1} + \sum_{k=1}^{4} \phi_k Hk_{i,c,t} + \psi(DEV_{i,c,t} \text{ or } CTAR_{i,c,t-1}) + \gamma_t + (\eta_i + \varepsilon_{i,c,t}) \quad \ldots\ldots$$

…Eq.1

Where $Zj_{i,c,t/t-1}$ are a set of observables from MFI balance sheets (other than lagged credit growth and MFI capitalization) at time *t/t-1* depending on the theoretical support for contemporaneous or lagged relationships, respectively. $Hk_{i,c,t}$ represents the macro-economic factors, $LB_{i,c,t-1}$ is the lagged dependent variable; $DEV_{i,c,t}$, and $CTAR_{i,c,t-1}$ are two measures of MFI capitalization: capital surplus/shortfall and lagged capital-to-asset ratio, respectively. β_1, π_j, ϕ_k, and ψ are the parameters to be estimated, α_0 is the intercept term, γ_t denotes a set of time fixed effects and where $(\eta_i + \varepsilon_{i,c,t}) = \mu_{i,c,t}$ is the 'fixed effects' decomposition of the error term.

Eq.1 shows that we have considered two ways that capital can affect credit growth. First, building on the Bernanke and Lown (1991) framework, we examined whether the capital-to-asset ratio affects loan growth directly through the book capital ratio. Second, we followed the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework

and investigated the relationship between MFI credit growth and capitalization through the *deviation* (i.e. the divergence between the actual capital ratio and the target capital) also called capital surplus or shortfall. Here, notice that in our model in *Eq.1*, consistent with Thibaut and Mathias (2014), we assessed the relation between the level of capitalization or the *deviation* at the end of period *t-1* and the change in lending during the period *t* which implies that the deviation is implicitly lagged in our credit growth equation.

The microfinance sector is diverse in nature with MFIs organized as banks, non-bank financial institutions, Credit Union / Cooperative, non-governmental organizations (NGOs) or Rural Bank; regulated or non-regulated; for profit or not for profit. This shows that there could be additional factors that determine the credit growth of MFIs in addition to the determinants of bank lending behavior. Hence, it is imperative that we account for such heterogeneity in examining the drivers of MFI lending behavior. In designing an appropriate econometric model, it is crucial that we start with a baseline specification which is based on some theoretical underpinnings and then test the robustness of the results as well as the effect of additional variables by adding the variables and/or dropping of certain other variables. Therefore, when we expand Equation 1 (Eq.1), our baseline model specification is as follows:

$$LB_{i,c,t} = \alpha_0 + \beta_1 LB_{i,c,t-1} + \psi(DEV_{i,c,t} \text{ or } CTAR_{i,c,t-1}) + \phi_1 LIQ_{i,c,t-1} + \phi_2 RISK_{i,c,t-1} + \phi_3 PROF_{i,c,t-1} + \phi_4 DEPG_{i,c,t} + \phi_5 FUNG_{i,c,t} + \phi_6 LNTA_{i,c,t} + \phi_7 LSCA_{i,c,t-1} + \phi_8 SSCA_{i,c,t-1} + \pi_1 GDPG_{i,c,t} + \pi_2 INF_{i,c,t} + \pi_3 EMP_{i,c,t} + \pi_4 CUP_{i,c,t} + \gamma_1 GFC2008_t + \gamma_2 GFC2009_t + (\eta_i + \varepsilon_{i,c,t})$$

Eq.2

Where $LB_{i,c,t-1}$ is the lagged dependent variable; $DEV_{i,c,t}$, and $CTAR_{i,c,t-1}$ are two measures of MFI capitalization: capital surplus/shortfall and lagged capital-to-asset ratio, respectively. *LIQ* is liquidity, *RISK* represents portfolio risk, *PROF* is Profitability, *DEPG* denotes deposit growth, *FUNG* is non-deposit funding growth, *LNTA* measures the size of the MFI, *LSCA* and *SSCA* are indicator variables of scale of the MFI (*LSCA*=large, *SSCA*=small), *GDPG* – gross domestic product growth, *INF* – inflation rate, *EMP* – employment rate, *CUP* – catch-up phenomenon, *GFC2008* and *GFC2009* are global financial crisis dummies, β_1, ψ, ϕ_k (k=1,2,3, …,8), and π_j (j=1,2, …,4) are the parameters to be estimated, α_0 is the constant term, γ_1 and γ_2 are a set of time fixed effects and where $(\eta_i + \varepsilon_{i,c,t}) = \mu_{i,c,t}$ is the 'fixed effects' decomposition of the error term.

The time fixed effects include Crisis2008 and Crisis2009 dummies to test whether the global financial crisis had significant effect on the credit growth of MFIs. Following Wagner & Winkler (2012), we separated the time fixed effects between 2008 and 2009 as the impact of the crisis on MFI credit growth in emerging markets might be significantly different for both years, specifically, smaller in 2008 than in 2009.

Han & Kim (2014) emphasize that the omission of the constant term in standard generalized method of moments estimation of dynamic panel data models leads the estimator to exhibit considerable bias and efficiency loss if the mean of the variable is large in magnitude unless full period dummies are included as exogenous regressors. They state that the problem can be resolved by simply including the constant term in the

instrument set or alternatively, one can just globally demean all the variables (y_{it} and all the regressors and instruments in more general models) before estimating the model. If full period dummies are present in the model, they are usually added to the instrument set automatically and no special treatment is required.

Han and Kim also state that the system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) also suffers similar problems when constant instruments are omitted. However, the inclusion of the global intercept in the levels equation enables dealing with any large mean and resolves most of the efficiency loss problem and hence, a constant term is included in our model.

Some factors such as GDP growth could influence simultaneously the deviation and the demand for lending, which would introduce spurious correlations. For instance, a slowdown of economic activity may affect the profitability of financial institutions and hence their implicit target as well as the investment opportunities of firms lowering the demand for credit. In line with Thibaut and Mathias (2014), we tried to address this issue by incorporating macroeconomic variables; this also allows a more flexible dynamics in the credit growth of MFIs.

"… with few exceptions (Di Bella, 2011) most microfinance sectors are small in volume terms" (Wagner & Winkler, 2012, P.7). Similarly, Burris (2007) states that despite encouraging performance of individual MFIs, the aggregate of MFI loans are too small to measurably impact a nation's economy. Consequently, since it is unlikely that microfinance credit growth influences GDP growth or other macroeconomic variables,

we believe that endogeneity is not a concern regarding macro-economic factors. Besides examining the effect of macroeconomic factors on credit growth, using alternative regression equations, we also examined whether industry related factors (such as legal, regulation and profit status) and the sub-region the MFIs are operating in impact the lending behavior of MFIs.

4.5.1.1 Description and measurement of variables and hypotheses

4.5.1.1.1 The dependent variable

The dependent variable is lending behavior (LB). The existing literature shows different alternative lending behavior measures: The (natural) logarithm of loans (Olokoyo, 2011;), (changes in) loans to asset ratio (Karmakar & Mok, 2013; Hessou & Lai, 2018), changes in the natural logarithm of loans (Gambacorta & Mistrulli, 2003; Gambacorta & Mistrulli, 2004; Covas, 2016; Gambacorta & Shin, 2018) and growth rate of loans (Bernanke & Lown, 1991; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Berrospide & Edge, 2010; Thibaut & Mathias, 2014; Cucinelli, 2016). In this study, the (natural) logarithm of loans is not appropriate as we employ a cross-country data. Although the data is available in U.S.D, we have converted it to local currency using the official exchange rates (current) in order to mitigate the effect of changes in currency value on credit growth.

The use of (natural) logarithm of loans could be a valid measure when we consider the within variation; however, it cannot be used to capture between variations since loan supply values are in different currencies. The loans to asset ratio is more appropriate to measure loan intensity rather than loan supply since the loans are scaled by total assets. The use of changes in the natural logarithm of loans is a generally accepted approach in

the existing literature as a measure of credit growth. Although this approach is simpler than the next measure, it is less precise as a measure of credit growth. Hence, in this study, we measured lending behavior as the growth rate of Gross Loan Portfolio (GLP) where GLP is all outstanding principals including current, delinquent, and renegotiated loans, but not loans that have been written off. Mathematically, it is measured as $(GLP_t/GLP_{t-1})-1$.

4.5.1.1.2 The explanatory variables

Capitalization: As stated earlier, we examined the effect of capitalization using two frameworks: One is the ratio of equity to total assets (*CTAR*). In the second approach, we used the deviation (*DEV*) described in the previous section. As to the relationship, Gambacorta and Mistrulli (2004) state that if financial institution's capitalization is poor and it is too costly to issue new shares, the financial institution will limit their lending in order to meet regulatory capital requirements. Moreover, the willingness and ability to extend loans could in part depend on MFI capitalization. MFIs with higher capitalization could be less risk averse (Michelangeli & Sette, 2016) and extend more loans since they can absorb more loan losses. In this respect, Bouvatier and Lepetit (2008) found that poorly capitalized financial institutions are constrained to expand credit.

In contrast, high level of capitalization can reveal risk averse and conservatively managed financial institutions which may be less willing to accept less credit worthy borrowers (Cucinelli, 2016). Cucinelli uncovered that banks with higher level of equity to total assets reduce lending. They assert that if banks have higher capitalization, equity holders will have more incentives to reduce bank lending activity in order to reduce the riskiness of assets. Alternatively, since the microfinance industry is highly capitalized, variations

in the level of capitalization may not lead to differences in lending behavior given that MFIs can reduce their lending when capital is too low but they cannot force borrowers to borrow when capitalization is high. Therefore, the expected relationship between lending behavior and capitalization is indeterminate.

Risk: In the existing literature, risk (*RISK*) is measured in different ways. One mechanism is to use the risk weighted assets to total assets ratio (Shrieves & Dahl, 1992; Aggarwal & Jacques, 2001). This approach assumes that the risk weights assigned to each category accurately reflect the true risk profile; this, however, contradicts with recent literature which argues that the risk weights do not take the varying levels of risk within a specific portfolio category into account and therefore, fail to reflect the actual risk profile of the financial institutions (Vallascas & Hagendorff, 2013). To overcome this problem, the prior studies also use the non-performing loans ratio as a measure of risk (Shim, 2013). Shim (2013) states that since the non-performing loans ratio deteriorates rapidly before an actual bank failure occurs, the non-performing loans ratio could capture asset quality better. Thus, in this study, we used the non-performing loans ratio for measuring risk. More specifically, we used the portfolio at risk greater than 30 days. It represents the portion of loans greater than 30 days past due, including the value of all renegotiated loans compared to gross loan portfolio[19].

The literature shows that an increase in credit risk is associated with a reduction in lending (Laidroo, 2012; Wagner & Winkler, 2012; Cucinelli, 2016) while the loan loss provisions ratio has higher impact on bank loans than the non-performing ratio

[19] We rely on the MIX Market definition and formula for most of our explanatory variables since data is obtained from the same.

(Cucinelli, 2016). Laidroo (2012) also assert that loan impairment charges capture the effect of credit risk more accurately in comparison to measures based on loan loss reserves since the former is a more timely measure of credit risk than the latter measures. Thus, in an alternative regression, we drop portfolio risk and add loan loss provisions to test which credit risk measures is more important in predicting lending behavior.

Igan and Pinheiro (2011) argue that there could be a positive relationship between lending and risk since "less sound banks become more aggressive and take more risks as they bet all their resources in a last effort to survive" (P.3). However, we believe that a higher portfolio risk is likely to lead to pressures on MFIs in meeting capital requirements; the higher the risk the higher the required regulatory capital which could lead MFIs to limit their lending.

A higher risk also implies higher loan loss provisioning which depletes capital which in turn forces a bank/MFI to limit its lending. Moreover, a higher portfolio risk also indicates lower cash flow which reduces the amount of money to be lent again. A higher portfolio risk could also imply that the borrowers are less creditworthy which results in lower effective demand for external finance which in turn negatively impacts lending (Bernanke & Lown, 1991). According to Wagner and Winkler (2012), financial institutions with higher portfolio risk will also be more cautious and limit lending. Therefore, we predict a negative relationship between lending and credit risk.

Profitability: Following Laidroo (2012) and Hessou and Lai (2018) we used the return on assets as a measure for profitability (*PROF*). It is calculated as net operating income

(less of taxes) compared to average assets. The prior studies document a positive relationship between lending and profitability (Laidroo, 2012; Hessou & Lai, 2018). Hessou and Lai argue that in MFIs, particulary credit unions, dividends paid to members store up in saving accounts and available for granting new loans. They also assert that profitability is positively associated with lending since credit unions adjust capital buffers by retaining earnings.

However, Laidroo (2012) establishes that the profitability of lending operations remains an important determinant of lending growth than the overall profitability of bank's operations. Laidroo (2012) confirms that while higher profitability of lending (as measured by net interest income to average total assets) is associated with an increase in lending, the alternative profitability measures namely operating profit (*ROA)* and return on equity (*ROE)* remain statistically insignificant.

On the other hand, we can argue that profitable MFIs could follow a conservative risk management strategy to generate consistently high profits. Thus, MFIs that are more profitable at time *t-1* could limit their lending at time *t* in order to limit portfolio risk. Thus, the expected relationship between MFI credit growth and profitability is undetermined.

Liquidity: In this paper, we measured liquidity *(LIQ)* using the non-earning liquid assets as a % of total assets. It is calculated as total cash and cash equivalents compared to total assets. Short-term investments are also considered as component of cash and cash equivalents. This measure is an important liquidity indicator in the microfinance industry.

Consistent with the findings of the prior studies (Gambacorta & Mistrulli, 2003; Berrospide & Edge, 2010; Laidroo, 2012; Hessou & Lai, 2018), we expect credit growth to be positively related to the liquidity of MFIs as higher liquidity ratio allows MFIs to shield their lending activity against shocks to the availability of external finance since deposit mobilization is difficult in the microfinance industry. In this respect, Laidroo (2012) argues that financial institutions with higher liquidity ratio could be better protected against shocks to their deposits, implying that higher liquidity permits increasing lending as the lending behavior of such financial institutions is less vulnerable to economic shocks.

Size: We measured size (*LNTA)* of the MFI using the natural logarithm of total assets; this is a common practice in the existing literature (See Berger & Udell, 2004; Laidroo, 2012; Tchakoute Tchuigoua, 2016; Hessou & Lai, 2018). Size may influence MFI's credit supply positively since large MFIs can attract more loanable funds to support their desired higher credit growth (Hessou & Lai, 2018). Large financial institutions could also enjoy diversification and economy of scale compared to small financial institutions (Aggarwal & Jacques, 2001; Berger et al., 2008).

Laidroo (2012) also argues that size could be positively associated with lending growth as bigger financial institutions have lesser information asymmetries and are less affected by economic shocks. Nevertheless, large and diversified MFIs may hold lower capital buffer since they have a strong risk management culture (Hessou & Lai, 2018). Consequently, the lower capital buffer may pressure MFIs to limit their lending. Thus, we cannot predict the direction of relationship between credit growth and size of MFIs. We

should, however, recognize that since bigger MFIs obviously have larger GLP in absolute terms, controlling for scale effects is essential in order to obtain a valid coefficient for the effect of size on credit growth (Laidroo, 2012). Hence, we also include large scale (*LSCA*) and small scale (*SSCA*) dummies to control for scale effects as MFIs with lower GLP at time *t-1* are likely to have higher credit growth at time *t* and those with higher base value GLP are likely to exhibit lower credit growth given that the lag GLP is the denominator in the computation of credit growth.

Deposit Growth: In this study, we used the rate of growth of deposits (i.e. ($Deposit_t/Deposit_{t-1}$)-1) as a measure of deposit growth (*DEPG*). We believe that these approach is more preferable compared to the deposit to asset ratio as a measure of deposit growth since changes in the latter measure does not necessarily imply changes in deposit growth. Since the data is available in USD and that changes in currency value may distort the magnitude of changes in deposits, we first convert the values to local currency at the official exchange rate, current and then calculate the growth rates. The growth of deposits could be positively associated with loan growth rate since deposits are the main[20] sources of loanable funds for many MFIs. Thus, we expect credit growth to be positively related to deposit growth.

(Non-deposit) Funding Growth: Funding growth (*FUNG*) captures capital inflows into the microfinance sector from domestic and international financial markets. It is measured as the growth of total non-deposit borrowings. Total non-deposit borrowings are calculated as the difference between total assets and the sum of equity and deposits. In all

[20] The mean and 50 percentile values for deposits to total assets ratio is approximately 40 percent for MFIs in Sub-Saharan Africa

other cases, we follow the same approach applied for deposit growth. Funding growth could influence loan supply positively as non-deposit funding liabilities are part of loanable funds. Therefore, we predict a positive sign for the coefficient of funding growth.

Macroeconomic Determinants: We included the macroeconomic factors to capture the effect of changes in loan demand. These factors include GDP growth, inflation, employment and GDP per capita. Since GDP growth (*GDPG*) and employment (*EMP*) have positive association with demand for loan, we expect these variables to influence credit growth positively. We included inflation (*INF*) in the set of covariates because, the GLP being a nominal variable, we do not want the credit growth to be mechanically driven by inflation (Thibaut & Mathias, 2014). In addition, inflation could capture the demand for loans. We use the natural logarithm of GDP per capita (*CUP*) to account for the different levels of economic development among countries in SSA. It is the most informative single indicator of the level of economic development. The catch-up phenomenon implies that wealthier economies have lower demand for loans than poorer economies and hence, we expect a negative coefficient.

Finally, we include the lagged dependent variable to test the existence of any persistence in MFI lending behavior. The use of dynamic panel data models also requires the inclusion of such variable. To control for time fixed effects, we include global financial crisis dummies (i.e. *GFC2008* and *GFC2009)*. We also include several indicator variables for MFI-specific time invariant components such as regulation, profit, and legal status dummies to control for individual fixed effects. In order to control for differences

in credit growth across different geographical areas, we also include location dummies. A summary of the description of the variables and hypotheses is available at the end as annex (Table A).

4.5.1.2 The capital adjustment process and lending behavior

Firms do not appear to be selecting their degree of leverage in a frivolous or random manner (Ross, Westerfield & Jaffe, 2003). Accordingly, several studies have examined the determinants of capital structure of non-financial firms (Flannery & Rangan, 2006; Lemmon, Roberts & Zender, 2008; Cook & Tang, 2010; Hovakimian & Li, 2011; and Oztekin & Flannery, 2012) and capital structure/capital adjustment of banks (Berrospide & Edge, 2010; Athanasoglou, 2011; Jokipii & Milne, 2011; Shim, 2013;Thibaut & Mathias, 2014). Given capital adjustment difficulty in financial institutions, the paper has investigated the capital adjustment process in a *partial* adjustment framework.

The partial adjustment framework has been widely applied in examining the dynamic nature of a firm's capital (or debt) adjustments and to estimate the adjustment speed towards its target level (Leary & Roberts, 2005; Flannery & Rangan, 2006; Shim, 2010). A partial adjustment model specifies that, at each period *t*, the MFI tries to close a proportion of the gap (λ) between its targeted capital ratio at time *t* and the actual capital ratio at time *t* – 1. Since we denoted the capital ratio of MFI *i* in country *c* at time *t* with $CAP_{i,c,t}$ and the targeted capital ratio of MFI *i* in country *c* at time *t* with $CAP^*_{i,c,t}$, our capital adjustment model has the following form:

$$CAP_{i,c,t} - CAP_{i,c,t-1} = \lambda(CAP^*_{i,c,t} - CAP_{i,c,t-1}) + \varepsilon_{i,c,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eq.3$$

Assuming that the market-required capital ratio can be correctly approximated by some set of observables from MFI balance sheets, macro-economic factor and a set of time invariant components, we modeled the target capital ratio as:

$$CAP^{*}_{i,c,t} = \beta_0 + \beta_j Xj_{i,c,t} + \nu_i \text{ ……..……Eq.4}$$

Where Xj represents a set of observables from MFI balance sheets, macro-economic factor, β_0 is the constant term and ν_i represents a set of MFI-specific time invariant components.

The Capital Adjustment Equation

In line with prior literature, we used portfolio risk (Shim, 2013; Goddard et al., 2015; Tchakoute Tchuigoua, 2016), profitability (Berrospide & Edge, 2010; Thibaut & Mathias, 2014; Tchakoute Tchuigoua, 2016), size (Berger et al., 2008; Shim, 2013; Thibaut & Mathias, 2014; Tchakoute Tchuigoua, 2016), liquidity (Jokipii & Milne, 2011; Shim, 2013; Thibaut & Mathias, 2014), deposits (Thibaut & Mathias, 2014), GDP growth (Shim, 2013; Thibaut & Mathias, 2014; Goddard et al., 2015) as potential determinants of MFI's capitalization. Finally, since the microfinance sector is diverse in nature – comprising of both regulated and unregulated MFIs, for profit and not-for profit MFIs as well as MFIs with different legal status, we also incorporated time invariant components ($LESj_i$) to capture individual fixed effects.

We included portfolio at risk since the riskiness of the loans held by MFIs could influence the target level of capital; MFIs with poor portfolio quality could avoid the risk

of failure by increasing their capitalization (Tchakoute Tchuigoua, 2016). On the other hand, since credit risk has a significant negative effect on profitability, MFIs with higher portfolio risk could have lower capital. The profitability of MFIs is also another variable that could predict capitalization. Since it is difficult to obtain equity capital in MFIs and MFIs do not generally make dividend payments, profitable MFIs could rely on internal financing to external financing to meet their funding needs. Higher profits also reduce the necessity to raise debt (Degryse et al., 2012 cited in Tchakoute Tchuigoua, 2015). Hence, financial institutions with higher earnings are likely to have higher capitalization (Shim, 2013).

The scale of MFIs[21] could also affect the level of MFI capitalization. Berger et al. (2008) states that large financial institutions could be more diversified, be more experienced in risk management, and benefit more from government guarantees (too big to fail hypothesis) and hence, may have lower capitalization. The target capital ratio of MFIs could also depend on the liquidity of MFI assets. Firms with lower liquid assets may reduce the probability of costly default by increasing their capitalization, that is, by lowering their leverage (Williamson, 1988; Sibilkov, 2009). Moreover, since liquid assets have lower risk weights, financial institutions with more asset liquidity may have lower target capital.

The availability of deposits could also influence the target capital ratio and hence, deposit growth is also included in our capital equation. We also include the GDP growth rate in the determinants of target capital to capture the effect of the business cycle. The

[21] It is represented by dummy variables which take a value of 1 for large scale MFIs denoted by LSCA, small scale MFIs represented by SSCA, otherwise, zero.

theoretical relationship between capitalization and GDP growth is unclear (Goddard et al., 2015). They explain this as follows: Forward-looking financial institutions might increase their capitalization during an upturn in order to be able to absorb losses and increase their resilience during a future downturn. On the other hand, myopic institutions might exploit lending opportunities to the full and deplete capital during an upturn.

Finally, legal status dummies are included to capture the effects of the charter types of MFIs on capitalization. NGOs and unregulated MFIs could be poorly leveraged because they are not allowed to mobilize public deposits in certain economies (Lafourcade et al., 2005). Similarly, NBFIs may have higher capitalization compared to Micro-banks and credit unions/coop. since they are financed by public equity from local governments and development associations.

Our target capital ratio (*Eq.4* shown earlier*)* has been specified as follows:

$$CAP^{*}_{i,c,t} = \beta_0 + \beta_j Xj_{i,c,t} + \nu_i$$

Therefore, when we expand *Eq.4* to incorporate all the potential determinants, the model for the implicit target is as follows:

$$\begin{aligned} CAP^{*}_{i,c,t} = {} & \beta_0 + \beta_1 RISK_{i,c,t} + \beta_2 PROF_{i,c,t} + \beta_3 LIQ_{i,c,t} + \\ & \beta_4 DEPG_{i,c,t} + \beta_5 LSCA_{i,c,t} + \beta_6 SSCA_{i,c,t} + \beta_7 GDPG_{i,c,t} \\ & + \sum_{j=1}^{4} \phi_j LESj_i \end{aligned} \qquad Eq.5$$

Where CAP denotes capitalization, β_k (K=1, 2, 3 …., 7) are coefficients for the respective predictor variables, ϕ_j represent coefficients of different legal status dummies

(*LES*) namely micro-banks, rural banks, credit unions/coop. and NGOs where the benchmark charter type is NBFI and $(\beta_0 + \sum_{j=1}^{4} \phi_j LESj_i) = \beta_i$ is the intercept for each MFIs. Other designations are as described in Table A attached as annex.

By replacing $CAP^*_{i,c,t}$ in *Eq.3* with the one given in *Eq.5* and rearranging the equation gives the following models:

$$CAP_{i,c,t} = (1-\lambda)CAP_{i,c,t-1} + \lambda(\beta_0 + \beta_1 RISK_{i,c,t} + \beta_2 PROF_{i,c,t} + \beta_3 LIQ_{i,c,t} + \beta_4 DEPG_{i,c,t} + \beta_5 LSCA_{i,c,t} + \beta_6 SSCA_{i,c,t} + \beta_7 GDPG_{i,c,t} + \sum_{j=1}^{4} \phi_j LESj_i) + \varepsilon_{i,c,t} \quad \text{...Eq.6}$$

$$CAP_{i,c,t} = \pi_1 CAP_{i,c,t-1} + \tilde{\beta}_1 RISK_{i,c,t} + \tilde{\beta}_2 PROF_{i,c,t} + \tilde{\beta}_3 LIQ_{i,c,t} + \tilde{\beta}_4 DEPG_{i,c,t} + \tilde{\beta}_5 LSCA_{i,c,t} + \tilde{\beta}_6 SSCA_{i,c,t} + \tilde{\beta}_7 GDPG_{i,c,t} + (\tilde{\beta}_0 + \sum_{j=1}^{4} \tilde{\phi}_j LESj_i) + \varepsilon_{i,c,t} \quad \text{..... Eq.7}$$

Where the parameter π_1 corresponds to $(1 - \lambda)$ which is a measure of persistence in MFI capitalization, λ is the speed of adjustment and $\tilde{\beta}_j$ represents the parameters of the respective vectors and equals to $\lambda\beta_j$, $\tilde{\phi}_j$ is the coefficient for the time invariant components (i.e. legal status dummies) and equals $\lambda\phi_j$, and $\tilde{\beta}_0$ is the constant and equals $\lambda\beta_0$. $\varepsilon_{i,c,t}$ denotes idiosyncratic error term.

Equation 7 (*Eq.7*) is the one we estimated. The inclusion of time invariant individual fixed-effects in the target capital ratio is deemed essential as the literature asserts that

capital ratios fluctuates mainly around a firm-specific time-invariant component (Flannery & Rangan, 2006; Lemmon et al., 2008; Gropp & Heider, 2010; Berrospide & Edge, 2010; Thibaut & Mathias, 2014). As the microfinance industry is diverse in nature where MFIs are organized with different charter types and with different profit and regulation status, the inclusion of MFI-specific time invariant components is considered quite essential. We included time invariant components namely legal status dummies and not individual fixed effects as our data set comprises large number of MFIs and inclusion of individual dummies is impractical.

With the set of estimated parameters of equation 7 (*Eq.7*), we recovered the *target* in equation 5 (*Eq.5*) by first deriving the long-run parameters β_j, ϕ_j, and β_0. Accordingly, we calculated the long-run effect of each firm specific explanatory variables and the macroeconomic variable as follows:

$$\beta_j = \frac{\tilde{\beta}_j}{(1-\pi_1)} \quad \text{..... } Eq.8$$

The long-run effect of the time invariant components (i.e. legal status dummies) is computed as:

$$\phi_j = \frac{\tilde{\phi}_j}{(1-\pi_1)} \quad \text{..... } Eq.9$$

The constant is calculated as follows:

$$\beta_0 = \frac{\tilde{\beta}_0}{(1-\pi_1)} \quad \text{..... } Eq.10$$

Once we estimate the implicit target ($CAP^*_{i,c,t}$), the deviation (i.e. capital surplus/shortfall) is calculated as follows:

$$DEV_{i,c,t} = CTAR_{i,c,t-1} - CAP^{*}{}_{i,c,t} \ldots\ldots\ldots Eq.11$$

If the deviation is positive, it shows capital surplus (i.e. the MFI is overcapitalized) and negative values imply capital shortfall (i.e. the MFI is undercapitalized). Then we estimated the impact of capitalization on credit growth of MFIs using the following model (Eq.2 shown in Section 4.5.1 of Chapter 4; since deposit growth and non-deposit borrowing growth do not have direct effects on MFI credit growth, we have omitted them in this model):

$$\begin{aligned} LB_{i,c,t} = {} & \alpha_0 + \beta_1 LB_{i,c,t-1} + \psi(DEV_{i,c,t}) + \phi_1 LIQ_{i,c,t-1} + \phi_2 RISK_{i,c,t-1} + \phi_3 PROF_{i,c,t-1} \\ & + \phi_4 LNTA_{i,c,t} + \phi_5 LSCA_{i,c,t-1} + \phi_6 SSCA_{i,c,t-1} + \pi_1 GDPG_{i,c,t} + \pi_2 INF_{i,c,t} + \\ & \pi_3 EMP_{i,c,t} + \pi_4 CUP_{i,c,t} + \gamma_1 GFC2008_t + \gamma_2 GFC2009_t + (\eta_i + \varepsilon_{i,c,t}) \end{aligned}$$

Given our dynamic panel model for the capital equation 7 (Eq.7), we estimate the short run coefficients in the capital equation using the Arellano-Bover/Blundell-Bond two-step Generalized Method of Moments (GMM) Windmeijer (2005) bias-corrected standard errors and recover the long run coefficients using the *Delta* method which employs the same approach as described above. See Section 4.6 for why the system GMM with bias correction is preferred.

For testing the presence of any non-linear effect of capitalization on credit growth and the moderating role of capitalization on the relationship between credit growth and the business cycle, an indicator variable reflecting the under- or over-capitalization, dummy variable, of MFIs at the firm level is developed. When positive, the deviation from the target denotes a situation where the MFI is over-capitalized and when negative it reflects

the MFI is under-capitalized compared to what would be implicitly required by market and regulatory forces.

4.6 Estimation Methodology

Linear dynamic panel data models contain lags of the dependent variable which in turn contain individual effects, fixed or random. By construction, the individual fixed effects are correlated with the lagged dependent variable, which makes the OLS estimator inconsistent (specifically, at least in large samples, biased upwards) and this correlation could not be eliminated by increasing sample size (Bond, 2002). The Fixed Effects estimator eliminates this source of inconsistency by transforming the equation to eliminate η_i. Specifically, the mean values of each variable (the dependent variable, the lagged dependent variable, explanatory variables, η_i and $\varepsilon_{i,t}$) are obtained, the original observations are expressed as deviations from these respective means, and then, the OLS estimator is used to estimate these transformed equations; this removes the individual fixed effects from the transformed equations since the mean of the individual effects η_i is itself η_i.

However, in panels with small time periods, the Fixed Effects estimator also induces a "non-negligible correlation between the transformed lagged dependent variable and the transformed error term" and this correlation could not disappear when we increase the sample size (Bond, 2002, P.144). Hence, the Fixed Effects estimator is also inconsistent and, at least in large samples, it is biased downwards where the bias becomes negligible

as the number of time periods increases[22] (Ibid). This shows that the Fixed Effects estimation technique could be biased given a short panel such as ours. Furthermore, the Fixed Effects estimator cannot estimate the effects of time invariant components as it drops them from the regression equation.

The Generalized Method of Moments (GMM) dynamic panel estimators are suitable in such cases. The Arellano-Bond (1991) and Arellano-Bover (1995)/Blundell-Bond (1998) linear generalized method of moments (GMM) estimators are designed for

> situations with 1) "small T, large N" panels, meaning few time periods and many individuals; 2) a linear functional relationship; 3) a single left-hand-side variable that is dynamic, depending on its own past realizations; 4) independent variables that are not strictly exogenous, meaning correlated with past and possibly current realizations of the error; 5) fixed individual effects; and 6) heteroskedasticity and autocorrelation within individuals, but not across them. (Roodman, 2007, P.1).

The Arellano-Bond estimator starts usually by differencing all variables, and hence, known as "difference GMM". The Arellano-Bover/Blundell-Bond estimator is derived from the estimation of a system of two equations, one is the original equation (with lagged first differences as instruments) and the other is the transformed one (with lagged levels as instruments) and is called "system GMM". The Arellano-Bover/Blundell-Bond estimator extends Arellano-Bond with an assumption that the fixed effects are not correlated with the first differences of instrumenting variables. This can dramatically increase efficiency as it allows the introduction of more instruments (Roodman, 2007).

[22] Flannery and Hankins (2013) document that the order of magnitude of the bias in the fixed-effects estimator of the coefficient on the lagged dependent variable as follows: 0.144 for T=6, 0.070 for T=12 and 0.026 for T=30 (Goddard et al., 2015)

In our case, the Arellano-Bover/Blundell-Bond estimator is able to increase the number of observations from 387 in Arellano-Bond estimator to 546 while the number of groups has been increased from 112 to 130 which show its increased efficiency. In addition to efficiency concerns, the Arellano-Bond estimator does not also allow us to estimate the effects of time invariant components as the differencing removes any time invariant explanatory variables. In comparison to the Fixed Effects estimator, the two-step system GMM also provides more economic information allowing testing the short-run and long-run effects of the independent variables. Hence, we preferred the system-GMM estimator to the differenced-GMM estimator.

The other problem is the choice between one-step and two-step system GMM estimation. The one-step GMM estimator is based on a weight matrix that assumes the error terms are i.i.d. while the estimator, $\hat{\beta}$, depends on the choice of the weight matrix in over-identified models. Because we have more instruments than parameters, we have an over-identified model. Therefore, the choice of the weight matrix does matter. So, the option is to use the two-step GMM estimator. However, the standard errors estimates of the two-step estimators are severely downward biased. Hence, we used Windmeijer[23] bias-corrected standard errors to resolve the bias of traditional two-step GMM standard errors observed in dynamic panel models (Roodman, 2007).

Accordingly, using the Arellano-Bover/Blundell-Bond two-step Generalized Method of Moments (GMM) Windmeijer bias-corrected standard errors, we estimated the short run coefficients and recovered the long run coefficients using the Delta method. The two-step

[23] A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics, 126: 25–51.

system GMM is appropriate to obtain consistent and unbiased estimates of the drivers of MFI lending behavior provided that the over-identifying moment conditions are valid and there is no autocorrelation in the idiosyncratic errors. Accordingly, we checked the absence of correlation between the error term and instruments using the Sargan test. We also tested the presence of first- and second-order autocorrelation in the first differenced residuals (AR-1 and AR-2).

4.7 Robustness Checks

This research aimed mainly at identifying the drivers of MFI lending behavior with particular focus on whether and how capitalization impacts the credit growth of MFIs. To this end, for the reasons mentioned in Section 4.6, we used the Arellano-Bover/Blundell-Bond two-step Generalized Method of Moments (GMM) Windmeijer bias-corrected standard errors to estimate the short run coefficients and recover the long run coefficients using the Delta method.

A research is considered good "if its results are due to the independent variable (internal validity), can be generalized/transferred to other populations or situations (external validity), and different researchers can record the same data in the same way and arrive at the same conclusions (replicable and reliable)" and hence, robust to empirical refutation (Scotland, 2012, P.11). To this end, apart from our effort to choose a consistent and efficient estimator, we tested the robustness of our benchmark model with different specifications and estimation techniques. In connection with the latter, in addition to our preferred estimation methodology, we applied the Fixed Effects estimator, two-step differenced GMM Windmeijer bias-corrected standard errors, one-step differenced GMM

standard errors robust and one-step system GMM standard errors robust in order to check the sensitivity of the results to changes in the estimation methodology. We also applied overlapping rolling GMM regressions to test the robustness of our model.

Most importantly, we additionally made time varying analysis since there may be changes in the sensitivity of MFI credit growth to each factor over time. Accordingly, using interaction terms of predictor variables with time period dummies (pre-crisis and post-crisis dummies), we examined whether the relationship between credit growth and the predictor variables during the global financial crisis substantially differs from the one observed during the pre-crisis period and post-crisis period.

CHAPTER 5: STYLIZED FACTS: SUB-SAHARAN AFRICA MICROFINANCE SECTOR AND MACROECONOMIC ENVIRONMENT

5.1 Introduction

In this chapter, we begin by documenting some stylized facts on the characteristics of the microfinance industry in Sub-Saharan Africa[24] and describe the trends in the key performance indicators including MFI credit growth, capitalization, portfolio risk, profitability, liquidity, asset size, deposit mobilization, deposit growth and non-deposit borrowing growth. Subsequently, we discuss the prospects and trends in the macro-economy of SSA countries in terms of GDP growth, inflation, employment and GDP per capita.

5.2. SSA Microfinance Sector

To examine the trend in the performance indicators, we relied on the data for the years 2004 to 2010 to obtain adequate and representative information for our analysis as the number of MFIs providing the required data to the MIX Market has declined significantly subsequent to the year 2010. The descriptive statistics, however, is based on data for the years 2004 to 2014 except for the variables measured as growth rates where the year 2004 is used as a base year. The descriptive statistics results are summarized in Table 3.

[24] This section is derived mainly from an article published in *Development in Practice* on 21 Dec. 2020, copyright Taylor and Francis, available online: http://www.tandfonline/10.1080/09614524.2020.1853060

Table 3: *Descriptive Statistics of MFI-Specific Factors*

Variables	Obs.	Mean	Std. Dev.
Credit Growth	971	0.4187262	0.8066005
Capitalization	1091	0.3390293	0.4321855
Risk (PAR)	884	0.0809814	0.1014272
Profitability (ROA)	996	-0.0116245	0.1085268
Liquidity	864	0.2095009	0.1479098
Asset Size (in USD)	1098	4.74e+07	2.34e+08
Deposit growth	716	0.518323	1.416215
Deposit to Asset	892	0.4086894	0.2692138
Non-deposit borrowing growth	958	0.5611368	6.152346

Source*: Statistical Analysis Based on MIXMARKET Data (Year 2004–2014)*

MFI Credit Growth, Capitalization and Portfolio Risk

While the Gross Loan Portfolio (GLP) of MFIs in SSA is growing fast on average by 42 percent annually (Table 3), the rate of growth in GLP is declining from time to time (Figure 1). In subsequent sections, we discuss what determines the credit growth of MFIs in SSA. The credit growth reached its peak of 64 percent during the year 2007; however, the growth rate declined significantly during the global financial crisis to about 29 percent (Figure 1).

In addition, Table 3 reveals that the microfinance industry in SSA is highly capitalized. The overall mean capital to asset ratio over the years 2004 to 2014 was around 34 percent. Nevertheless, there was more or less a temporal downward trend in the level of capitalization over the period under consideration. Furthermore, the standard deviation reflects that there was significant variability in the level of capitalization. In chapter six,

we discuss what determines this disparity in MFI capitalization and whether differences in the level of capitalization influence the magnitude of credit growth of MFIs.

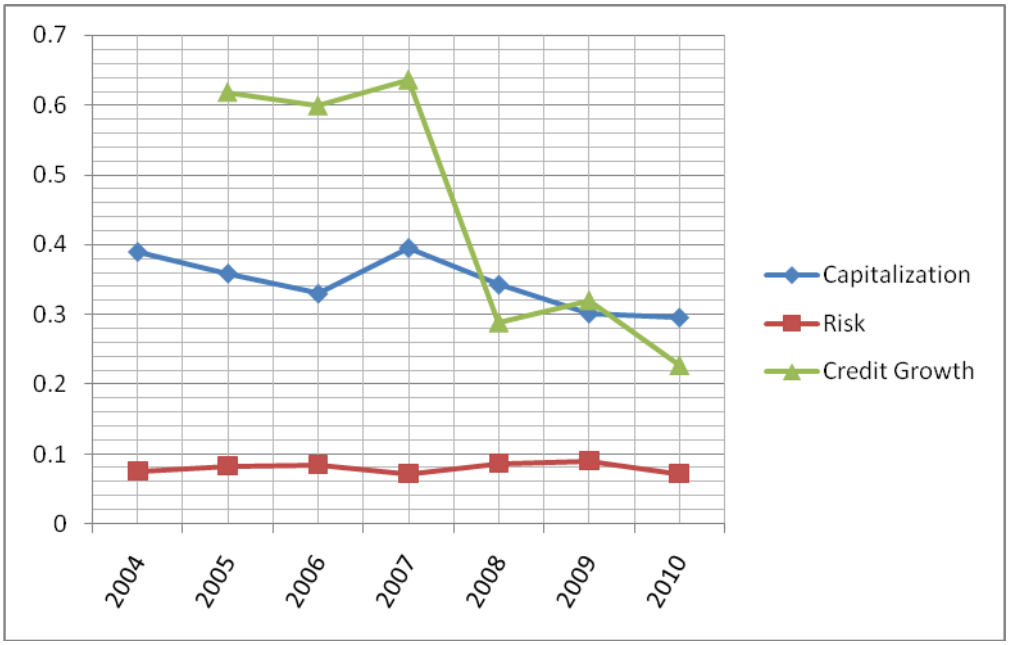

Figure 1: *Trends in Credit Growth, Capitalization and Portfolio Risk*

The results also show that the level of portfolio risk of MFIs in SSA was not within the comfort zone; the PAR >30 was on average about 8 percent (Table 3). This finding contradicts with Lafourcade et al. (2005) who found that MFIs in Africa exhibit high portfolio quality, with an average portfolio at risk over 30 days of only 4 percent; this may be due to sample selection bias as these authors considered only "diamond three" MFIs or a decline in portfolio quality has occurred in the microfinance industry in subsequent years. Moreover, a significant deterioration in portfolio quality was observed during the global financial crisis (Figure 1). The variability in portfolio risk (as measured by the standard deviation) was also very significant during the period under investigation (Table 3).

A further analysis of the performance of MFIs by Sub-region and charter type is also made using One-Way ANOVA (Table 4). Table 4 reveals that while the magnitude of credit growth is similar by sub-region (Prob > F=0.263), the level of capitalization and portfolio risk of MFIs vary across sub-regions (results are significant at 1 percent level). We also uncovered that the performance of MFIs in terms of the aforementioned three indicators significantly differs across legal status (Table 4); the results are significant at less than 5 percent level.

Table 4: *One-Way ANOVA Results of Performance across Region and Legal Status*

	Sub-Region of MFIs					**Legal Status of MFIs**					
Variables	Eastern Africa	Western Africa	Central Africa	Southern Africa	**ANOVA Test Sig.**	Bank	NBFI	Credit Unions/Coop.	NGO	Rural Bank	**ANOVA Test Sig.**
Credit Growth	0.47	0.36	0.43	0.47	**0.263**	0.493	0.499	0.292	0.437	0.359	**0.032**
Capitalization	0.36	0.30	0.30	0.45	**0.001**	0.274	0.398	0.291	0.368	0.131	**0.000**
Risk (PAR)	0.07	0.08	0.14	0.06	**0.000**	0.06	0.077	0.095	0.075	0.156	**0.000**
Profitability (ROA)	-0.01	-0.003	-0.01	-0.04	**0.01**	0.007	-0.003	0.003	-0.043	0.040	**0.000**
Liquidity	0.21	0.18	0.35	0.21	**0.000**	0.25	0.20	0.218	0.182	0.351	**0.000**
Deposit growth	0.57	0.43	0.39	0.82	**0.096**	0.694	0.591	0.191	0.712	0.219	**0.002**
Deposit to Asset	0.36	0.45	0.58	0.26	**0.000**	0.554	0.312	0.573	0.269	0.708	**0.000**
Non-deposit borrowing growth	0.41	0.43	1.09	0.78	**0.714**	0.83	0.366	0.187	1.029	0.202	**0.523**

Source: *Statistical Analysis Based on MIX Market Data (Year 2004 to 2014)*

The diagnosis test for ANOVA results, however, shows that the Bartlett's test for equal variances is below 5 percent level of statistical significance in all models, so we reject the assumption that the variances are homogeneous. However, many people believe that ANOVA is a robust test in that it does not matter if the assumptions are violated, still the results will be valid. Alternatively, Field (2009) establishes that ANOVA is a general

linear model (GLM) and so is in fact the same as multiple regression. Thus, we also checked the validity of the results running a series of multiple linear regressions with standard errors robust to heteroskedasticity. We confirm that still the results are consistent. The regression results are summarized in Table 5.

The multiple linear regression apart from its benefit of allowing testing the robustness of One-Way ANOVA results when the Bartlett's test for equal variances assumption is not met as it allows the use of the option "standard errors robust to heteroskedasticity", it also serves to get further information about which MFIs (location-wise or legal status-wise) do better or worse which the One-Way ANOVA could not since legal status has five categories and the One-Way ANOVA could tell us only joint significance.

Table 5: *Regression Results of Performance across Region and Legal Status*

Dependent Variable	Beta Coef. of Independent Variables[a]			Constant	Model Sig.	Beta Coef. of Independent Variables[b]				Constant	Model Sig.
	Western Africa	Central Africa	Southern Africa			Bank	Credit Unions/Coop.	NGO	Rural Bank		
Credit Growth	**-0.11**	**-0.05**	**-0.00**	**0.47*** **	**0.209**	**-0.005**	**-0.21*** **	**-0.06**	**-0.14**	**0.50*** **	**0.006**
Capitalization	**-0.07**	**-0.07**	**0.08***	**0.36*** **	**0.000**	**-0.12*** **	**-0.11** **	**-.03**	**-0.27*** **	**0.40*** **	**0.000**
Risk (PAR)	**0.02** **	**0.07*** **	**-0.00**	**0.07*** **	**0.000**	**-0.02** **	**0.02** **	**-0.00**	**0.08***	**0.08*** **	**0.000**
Profitability (ROA)	**0.008**	**-0.001**	**-0.03***	**-0.01**	**0.043**	**0.01**	**0.007**	**-0.04*** **	**0.04*** **	**-0.00**	**0.000**
Liquidity	**-0.03*** **	**0.14*** **	**-0.00**	**0.21*** **	**0.000**	**0.05*** **	**0.02**	**-0.02**	**0.15*** **	**0.20*** **	**0.000**
Deposit growth	**-0.14**	**-0.18**	**0.25**	**0.57*** **	**0.083**	**0.10**	**-0.40*** **	**0.12**	**-0.37*** **	**0.59*** **	**0.000**
Deposit to Asset	**0.1*** **	**0.23*** **	**-0.1*** **	**0.36*** **	**0.000**	**0.24*** **	**0.26*** **	**-0.04***	**0.40*** **	**0.31*** **	**0.000**
Non-deposit borrowing growth	**0.02**	**0.68**	**0.37**	**0.41**	**0.441**	**0.46**	**-0.18**	**0.66**	**-0.16**	**0.37**	**0.306**

Source: *Statistical Analysis Based on MIX Market Data (Year 2004 to 2014)*

***The result is significant at 1 percent level, **Significant at 5 percent level and *Significant at 10 percent level. [a]The benchmark sub-region is Eastern Africa. [b]The benchmark legal status is NBFI.

As to the effects of location and legal status on MFI portfolio quality, capitalization, and credit growth, the findings further revealed that southern and eastern Africa MFIs have better portfolio quality than western and central Africa MFIs (Table 5). Moreover, Table 5 shows that southern Africa MFIs rely most heavily on equity to finance assets. We also found that credit unions/cooperatives have the lowest credit growth; whereas, NBFIs have the highest credit growth (Table 5). The credit growth of NGOs is also encouraging since it is comparable to NBFIs and micro-banks (Table 4 & Table 5); the critical concern could be: Can NGOs sustain this growth rate of about 44 percent in the future? In this respect, it is important to know the level of capitalization of NGOs.

Our findings show that rural banks have the lowest capitalization while NGOs and NBFIs are the most dependent on equity funding. Therefore, the higher capitalization of NGOs could increase their potential for more borrowings. Accordingly, since MFI lending behavior plays a critical role in the financial sustainability of MFIs (Tehulu, 2013) and poverty alleviation endeavor (Imai et al, 2012), allowing NGOs to mobilize deposits or encouraging them to increase their deposit mobilization[25] could help these institutions to sustain their rapid credit growth as well as expand their outreach. Apart for MFI funding, deposits are also important corporate governance mechanism since depositors can discipline the management towards its goals (Muriu, 2011). Finally, we found that while micro-banks have the highest portfolio quality, rural banks have the lowest portfolio quality (Table 5).

[25] Some NGOs are already allowed to mobilize deposits.

MFI Profitability and Liquidity

The results show that the MFIs in SSA are not profitable; the return on asset of MFIs was on average around negative 1 percent and negative in each of the years 2004 to 2014 implying that the microfinance industry in SSA was not profitable in general (Table 3 and Figure 2 for more information). One explanation for profitability problems of African MFIs is that the MFIs earn low financial revenues which do not cover the high operating expenses in the region (Lafourcade et al., 2005). Moreover, MFIs in SSA seem to have focused on poverty reduction rather than financial sustainability. However, the standard deviation in ROA was approximately 11 percent indicating that certain MFIs were profitable while others were operating at a loss (Table 3). Specifically, the regression results show that while MFIs organized as rural banks were most profitable, those organized as NGOs were the most unprofitable MFIs (Table 5); which makes the sustainability of NGOs questionable.

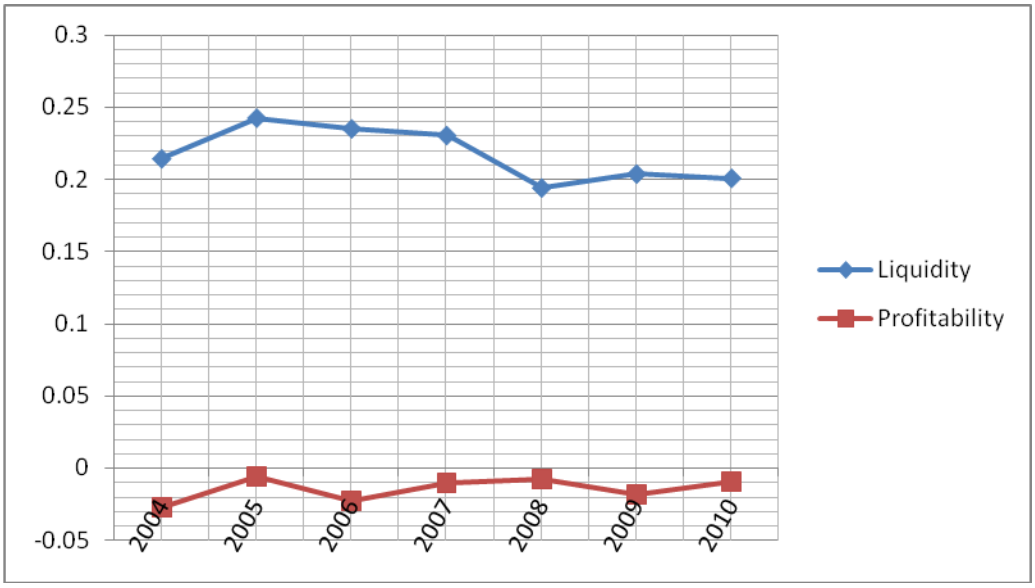

Figure 2: *Trends in Profitability and Liquidity*

NGOs are the most unprofitable because they have the highest operating expenses compared to other legal form MFIs while their financial expense and loan loss provisioning expense is comparable to that of micro-banks and NBFIs; in particular, NGOs report the highest administrative and personnel expenses (Table 6). This may be a manifestation of the agency problem as managers may be inefficient and/or given their managerial power, managerial rent seeking may be reflected in their pay arrangements as the board may be weak.

The role of the board is the same as private organizations: To control the managerial power and reduce organizational inefficiencies (Andrés-Alonso et al., 2009 cited in Tchakoute-Tchuigoua, 2010); however, since managers in NGOs have more autonomy in decision making, they seem to have greater managerial power (Tchakoute-Tchuigoua, 2010). The result is consistent with the prior literature which argues that NGOs have less effective governance system than banks and NBFIs as they lack real owners with monetary incentives and have social rather than commercial orientation; this contributes to weaker financial performance (Ledgerwood & White, 2006). Across regions, while MFIs in all regions generate negative returns on average, MFIs in Southern Africa are the most unprofitable MFIs.

Table 6: *Regression Results: The Comparative Efficiency/Revenue of MFIs*

Performance Indicators	**Legal Status[a]**					
	Micro Bank	**Rural Bank**	**Credit union/coop.**	**NGO**	**_cons**	**Model Sig.**
Total expense to assets	0.0119	-0.094***	-0.12***	0.0679***	0.2827***	0.0000
Provision for loan impairment to assets	0.00264	-0.011***	-0.0043**	0.0041	0.0186***	0.0010
Operating expense to assets	0.0104	-0.074***	-0.10***	0.066***	0.23***	0.0000
Administrative expense to assets	0.017**	-0.033***	-0.039***	0.032***	0.114***	0.0000
Personnel expense to assets	-0.008	-0.034***	-0.059***	0.032***	0.113***	0.0000
Financial expense to assets	-0.0001	-0.009***	-0.018***	-0.0025	0.035***	0.0000
Financial revenue to assets	0.023	-0.05***	-0.118***	0.026**	0.28***	0.0000

[a] The benchmark legal status is NBFIs, *** statistical significance at 1 percent level, ** statistical significance at 5 percent level and *statistical significance at 10 percent level.

The findings also revealed that the non-earning asset as a percentage of total assets, which is a measure of liquidity, was more or less stable at an average of about 21 percent over the period considered (Figure 2). However, the standard deviation, which is 15 percent, shows the variability in liquidity among MFIs had been significant (Table 3). We found that MFIs operating in central Africa as well as MFIs organized as rural banks were most liquid; on the other hand, MFIs operating in western Africa and MFIs organized as NGOs and NBFIs were least liquid (Table 5). This implies that, given the rapid credit growth of MFIs, high reserve/liquidity requirement in some MFIs (eg. MFIs in Ghana[26] and Ethiopia[27]) and that any institutional depositors could withdraw substantial amount of funds at any given time (CGAP, 2010), certain MFIs could face

[26] "Ghana has comparatively high reserve requirements. *Rural banks* must hold 5% of total deposit liabilities with the ARB Apex Bank, 8% as primary (cash and balances with other banks) and 20% to 30% as secondary (Government and Bank of Ghana bills, bonds and stocks) reserve requirements. The percentage rate for the secondary reserve requirement depends on the loan recovery rate." (Staschen, 2003, P.31).

[27] The liquidity ratio for re-registered MFIs is 20% (Ibid).

liquidity problem to meet withdrawal and loan demands if they cannot expand their depositor/funding base since it may be difficult to secure adequate deposits/funds especially during periods of weak economic conditions.

MFI Funding and Asset Size

One of the main sources of loanable funds for MFIs is equity capital, discussed earlier. Other main sources include deposits and non-deposit borrowing. The microfinance industry in SSA secures on average around 41 percent of its total funding from deposits (Table 3). However, the degree of reliance on deposits as sources of funds varies across MFIs as evidenced by the varied degree of financial intermediation offered by the MFIs; while certain MFIs provide high financial intermediation and others low, some others offer no financial intermediation. This variability is also reflected in the standard deviation of deposits to assets ratio, which is about 27 percent (Table 3). In this regard, we found that MFIs operating in central Africa and MFIs with rural bank legal status have high deposit mobilization (as measured by the deposits to assets ratio) whereas MFIs organized as NGOs and MFIs operating in southern Africa have low deposit mobilization (Table 5).

The results in Table 3 also show rapid growth of MFI's deposits; deposits had been increasing annually on average by approximately 52 percent. However, note in Figure 3 that the deposit growth line is more or less downward sloping and the level of deposit mobilization is more or less constant across time. Hence, the decline in deposit growth could imply restraint against unnecessary dependence on deposit funding and a diversification of funding sources or it could be in part due to scale effects. It could also

imply that branch expansions and/or deposit mobilization efforts by MFIs to secure more and more deposit funding over time was limited. The results also revealed that non-deposit borrowing is not a stable source for MFI funding (Figure 3). On the other hand, the MFIs in SSA are growing larger over time (Figure 4); in six years time (i.e. from year 2004 to 2010), the size of MFIs has increased to more than five-fold.

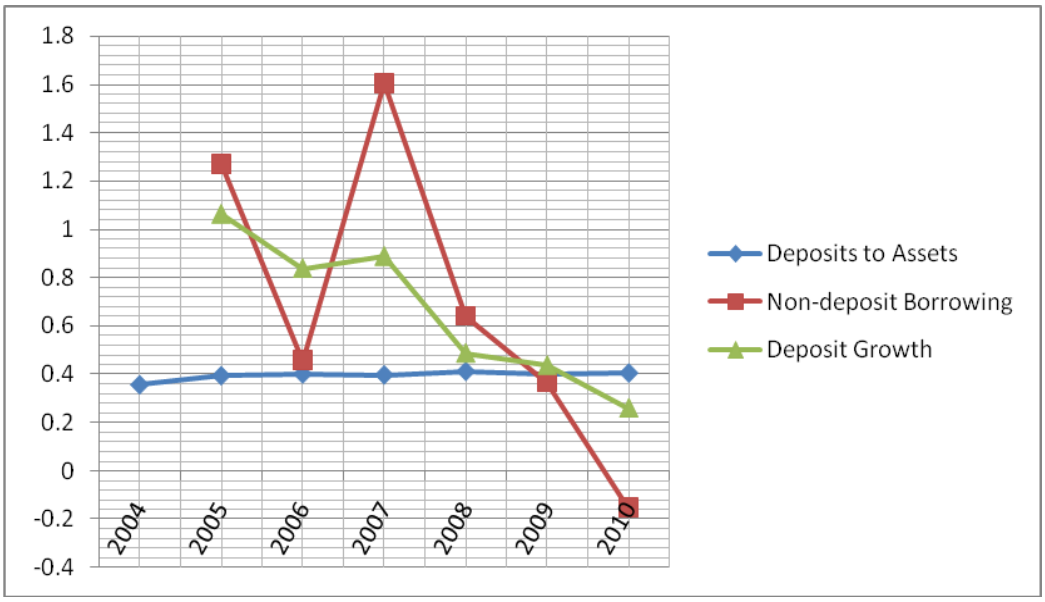

Figure 3: *Trends in MFI Funding*

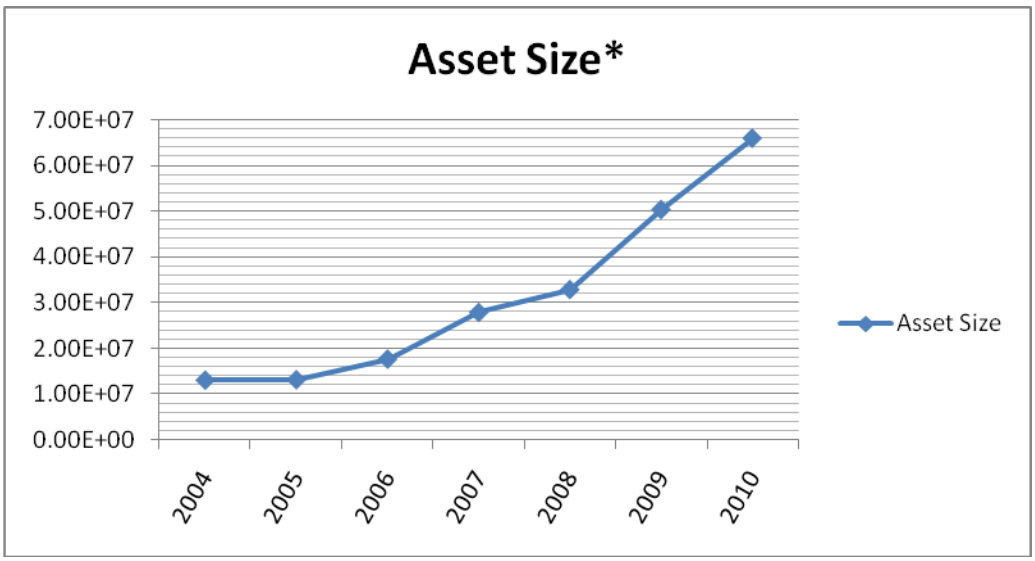

Figure 4: *Trends in MFI Asset Size*

*Total assets are measured in USD

From our previous discussions, we can also note that Rural Bank reports lower capitalization/solvency and higher portfolio at risk but also higher liquidity and deposit assets ratios in comparison to other types of MFIs. The higher deposit assets ratio suggests that Rural banks rely more heavily on deposits rather than equity capital and hence, exhibit lower capitalization. The higher liquidity but lower capitalization of Rural banks confirms that financial institutions with more asset liquidity hold lower capital since the required minimum risk based regulatory capital is lower in these institutions as liquid assets have lower risk weights. The higher portfolio risk in these MFIs implies Rural banks are serving riskier clients in comparison to other legal form MFIs. Although the deposit mobilization and liquidity of Rural banks are encouraging, the higher portfolio risk but lower capitalization suggests that if these MFIs are not able to manage credit risk properly, high loan defaults could deplete capital, and thereby affecting credit supply from these institutions negatively.

Rural banks are also most profitability since they are most efficient compared to NBFIs, micro banks and NGOs (Table 6). However, it seems that these MFIs underestimate the provision for loan impairment (Table 6) given the riskiest loan portfolio these institutions hold. While Rural banks are also more pro-poor as they charge clients lower financial revenues (Table 6), the findings imply these institutions should make an appropriate amount of loan loss provisioning for the anticipated loan defaults in order for their capitalization reflect the true risk of insolvency and so that taking timely corrective actions could be possible.

Given the results, we conclude that legal status and location have significant effects on the performance of MFIs in SSA. The results establish that legal status specific policies are necessary to support MFIs in the effort to fight against poverty. Specifically, the findings support prior studies that suggest either for the transformation of NGOs into microfinance banks or NBFIs (Ledgerwood & White, 2006; Fernando, 2004; D'Espallier, Goedecke, Hudon & Mersland, 2017) or that advise NGOs to scale up best practices of other MFIs, for example, allowing well performing NGOs mobilize savings to expand outreach, than transformation (Mersland & Strøm, 2008).

The choice for the latter (specifically, savings mobilization) could depend on opportunities for obtaining future donations to support more deposit mobilization as NGO MFIs grow larger in the future, since adequate capitalization is essential to meet not only capital requirements but also market constraints. Thibaut and Mathias (2014) argue that even when regulatory capital requirements are not binding, it does not mean that financial institutions are not capital constrained at all; market forces could also matter since the level of capitalization is a good indicator of bank/MFI solvency and no one wants to deposit money in a bank/MFI with low solvency.

Note also that problems owing to lack of owners with monetary incentives and managerial power in NGOs could less likely be resolved by scaling up best practices of other MFIs so long as the agency problem still persists. In the light of the recent empirical evidence that show a positive association of equity (and a negative association of debt/micro-savings) with the financial performance of MFIs (Chikalipah, 2019), it is

also questionable whether deposit mobilization could help weak NGOs achieve the dual goals of financial sustainability and social impact.

Given that transformation helps MFIs to significantly cut down their operating expenses due to the improved governance system (D'Espallier et al., 2017), it seems that transformation into shareholder owned MFIs could be more appropriate to weak NGOs than well performing NGOs. This is consistent with the literature that argues that the transformation of NGOs to NBFCs may not improve the performance of Indian MFIs since NGOs outperform NBFCs in all dimensions of financial performance except for social performance where both have the same performance (Ghose et al., 2018). Hence, if regulatory authorities allow such well performing NGOs to access savings, these MFIs will be able to expand credit access to the poor and improve their social performance.

Additionally, since transformation is a time consuming and extremely challenging process, transformation of NGOs could be less useful approach than allowing savings mobilization in the case of well performing NGOs. As discussed in a subsequent paragraph, the relative performance of NGOs also depends on the location of MFIs. Consequently, the choice between the two strategies shall also take into account the location of MFIs and more importantly, the performance of the individual NGO MFI.

Finally, we found that the response of MFI performance to differences in legal status of MFIs depends on the location of the MFIs (Table 7); this result partly depends on the performance measures used as the basis of comparison. We found that legal status does not matter in the profitability of MFIs in eastern Africa; however, it significantly

influences profitability of MFIs in all other regions of Africa. Similarly, there is no significant difference in portfolio risk across legal status of MFIs in eastern Africa and southern Africa while the legal form of the MFIs significantly affects portfolio quality of MFIs in western Africa and central Africa.

Table 7: *The Effect of Legal Status on MFI Performance by Region*

Region	Legal Status[a]	Outcome Variables				
		Credit Growth	**Capitalization**	**Profitability**	**Portfolio Risk**	**Deposit Mobilization**
Eastern Africa MFIs	Micro-Banks	-0.13	-0.12***	0.01	0.02	0.37***
	Credit Union/Coop.	-0.10	0.80	0.02	0.003	0.15***
	NGOs	0.05	-0.02	-0.04*	0.001	-0.01
	Rural Bank	-0.0021	-0.19***	0.02	-0.05	0.43***
	Constant	0.49***	0.35***	-0.004	0.06***	0.28***
	Model Sig.	0.6928	0.0000	0.2117	0.3724	0.0000
Western Africa MFIs	Micro-Banks	-0.226	-0.09	0.06***	-0.04***	-0.05
	Credit Union/Coop.	-0.44**	-0.15**	0.008	0.02	0.10*
	NGOs	-0.35*	-0.09	-0.02	0.03*	-0.16***
	Rural Bank	-0.37	-0.29***	0.05***	0.10**	0.26***
	Constant	0.70***	0.41***	-0.005	0.06***	0.45***
	Model Sig.	0.0971	0.0000	0.0000	0.0000	0.0000
Central Africa MFIs	Micro-Banks	0.46	-0.25***	0.04*	-0.11***	0.28***
	Credit Union/Coop.	-0.11	-0.21***	0.02	0.04	0.18***
	NGOs	0.13	-0.12	-0.02	-0.10***	-0.001
	Rural Bank	NA	NA	NA	NA	NA
	Constant	0.41***	0.41***	-0.02	0.15***	0.50***
	Model Sig.	0.3140	0.0007	0.0240	0.0000	0.0014
Southern Africa MFIs	Micro-Banks	0.22*	-0.21***	-0.04	-0.02	0.36***
	Credit Union/Coop.	0.04	-0.30***	-0.02	0.02	0.54***
	NGOs	0.14	0.04	-0.12***	-0.01	-0.02
	Rural Bank	NA	NA	NA	NA	NA
	Constant	0.36***	0.54***	0.02	0.07***	0.08***
	Model Sig.	0.2227	0.0000	0.0007	0.2351	0.0000

[a] The benchmark legal status is NBFIs, *** statistical significance at 1 percent level, ** statistical significance at 5 percent level and *statistical significance at 10 percent level.

The results also show that the relative performance of NGOs depends on the location of MFIs. In western and central Africa, NGOs reported the same level of profitability as NBFIs; whereas, in southern Africa, NGOs reported a return on asset of negative 10

percent which is 12 percent lower than that achieved by NBFIs. Nevertheless, the findings establish that legal status has a robust significant effect on MFI capitalization and deposit mobilization regardless of the location of MFIs; though, the issue of which legal status is doing better still depends to some extent on the location of MFIs. The results revealed that, more or less, NGOs and NBFIs depend more heavily on equity than rural bank, micro-banks and credit union/coop. and rural bank, micro-banks and credit union/coop. have higher deposit mobilization than NGOs and NBFIs.

We also noticed that, although the findings in Table 5 show significant difference in credit growth across legal status when the whole sample is considered, the results hold true during contractions only for MFIs in western Africa where credit unions/cooperatives and NGOs have exhibited significantly lower credit growth than other legal form MFIs at 5 percent and 10 percent level of significance, respectively; whereas, legal status has no effect on the credit growth of MFIs in all other regions of Africa (Table 7). Accordingly, we conclude that location has moderating effect on the relationship between MFI performance and legal status, at least when considering the three performance indicators namely credit growth, profitability, and portfolio quality. Our analysis here, however, has been limited to five key performance measures viz. credit growth, capitalization, deposit mobilization, profitability, and portfolio quality in order to limit the scope and avoid complications.

The results discussed so far, apart from introducing the stylized facts on the microfinance industry, raise two important concerns which we address in this study: 1) Do variations in the magnitude of MFI specific factors viz. capitalization, portfolio risk, profitability,

liquidity, asset size, deposit growth, deposit mobilization and non-deposit borrowing growth matter in the lending behavior of MFIs in SSA? And 2) Will legal status still be a determinant of lending behavior after controlling for the MFI specific and macroeconomic variables? Or conversely, will those other included variables absorb the predictive power of legal status as other determinants may mediate the relationship between credit growth and legal status?

5.3 SSA Macroeconomic Environment

In this section, we describe the trends and prospects in the macro-economy of countries in SSA. The descriptive results show that the economy of African countries is growing on average by about 5.9 percent (Table 8). This is encouraging especially since African countries have been able to sustain their economic growth and the GDP growth is steady (Figure 5). However, the economic growth is largely driven by inflation.

The inflation rate in SSA economies had been on average of around 8.3 percent. This implies that people who have already acquired assets and are relatively rich will continue to be wealthy and those who have no assets continue to be poor. In SSA where half of the population lives below poverty line and people are struggling even to cover their basic needs, it is questionable whether the prevailing economic growth reduce poverty in Africa given the high inflation rate in these economies. In this regard, the microfinance industry could, however, help the poor to acquire assets and start producing and selling goods and services to enhance their income thereby benefiting from the economic growth.

Table 8: *Descriptive Statistics of Macroeconomic Variables*

Variables	Obs.	Mean	Std. Dev.
GDP Growth	1138	5.884279	3.458247
Inflation	1137	8.321363	7.022377
Employment	1138	68.34934	11.30752
GDP per Capita (USD)	1138	831.2759	906.1183

Source: *Statistical Analysis Based on World Bank Data (Year 2004–2014)*

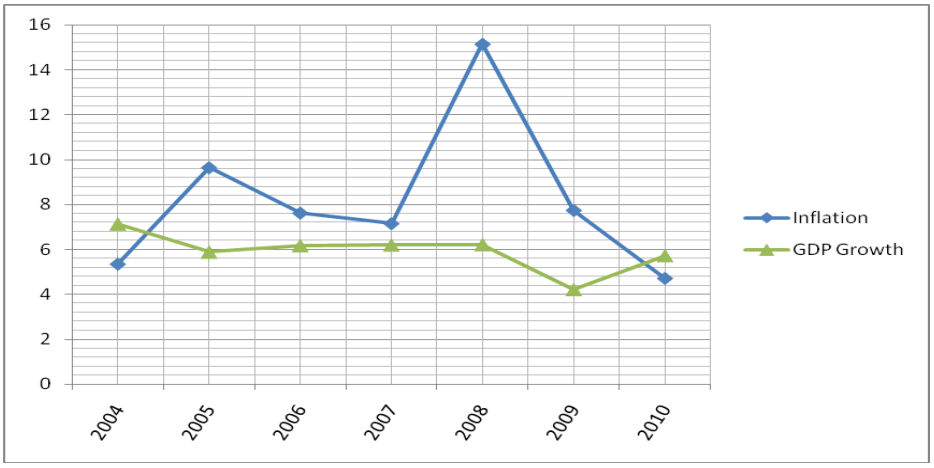

Figure 5: *Trends in GDP Growth and Inflation*

Figure 6 and Figure 7 show that there are some improvements in employment opportunities and income per capita from time to time in countries of SSA. Eastern Africa countries are leading other regions of Africa in economic growth and this seems to contribute the most in employment opportunities in these economies as this region has also exhibited the highest employment rate (Table 9). Given that eastern Africa countries have the lowest income per capita and the highest inflation, microfinance is crucial to the poor people in this region to make investments and produce goods and services for sale and take advantage of the economic growth and the increased aggregate demand.

However, in section 5.2.1 (Table 5), we show that location has no effect on the credit growth of MFIs although our findings revealed a significant difference in macroeconomic conditions among the four regions of Africa (Table 9). This could imply that either the demand factors does not influence the credit growth of MFIs and any changes in loan supply are rather due to supply factors or differences in supply factors across locations have mitigated the effect of demand factors on loan growth since our model (Table 5) does not control for the supply factors. In subsequent sections, we test whether differences in the macroeconomic conditions namely differences in GDP growth, inflation, employment and GDP per capita influence the lending behavior of MFIs in SSA after controlling for the supply factors. We also test whether the location of MFIs influences the credit growth of MFIs by capturing several unobserved idiosyncrasies that could impact MFI lending behavior.

Figure 6: *Trends in Employment*

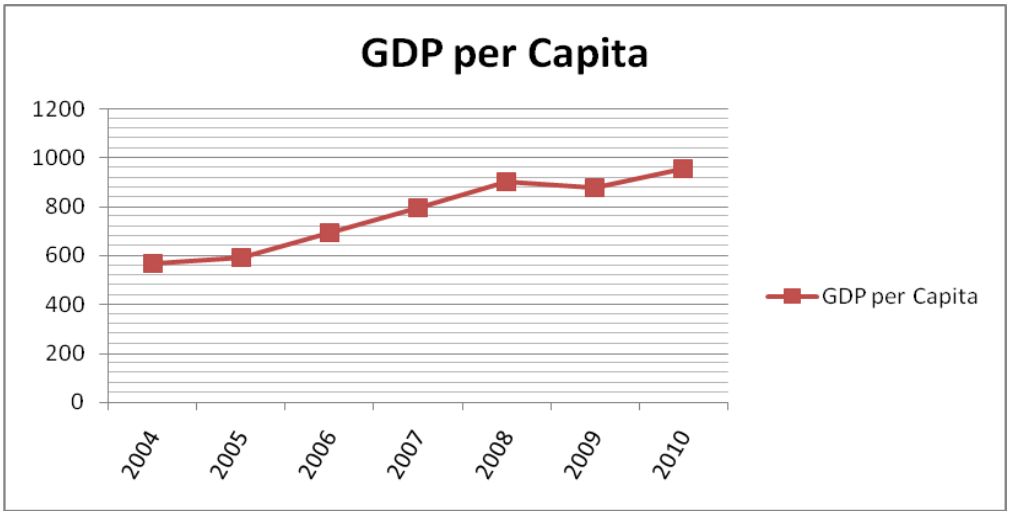

Figure 7: *Trends in GDP per Capita*

Table 9: *Regression Results of Macroeconomic Realities across Region*

Dependent Variable	Beta Coef. of Independent Variables[a]			Constant	Model Sig.
	Western Africa	Central Africa	Southern Africa		
GDP Growth	-2.68***	-2.80***	-1.95***	7.72***	0.0000
Inflation	-5.16***	-5.12***	-1.33**	11.42***	0.0000
Employment	-8.20***	-1.87***	-6.20***	73.18***	0.0000
GDP per Capita (USD)	247***	330***	872***	542***	0.0000

Source: *Statistical Analysis Based on MIX Market Data (Year 2004 to 2014)*

[a]The benchmark sub-region is Eastern Africa. ***The result is significant at 1 percent level, **Significant at 5 percent level and *Significant at 10 percent level.

5.4 Summary of Main Findings

In this chapter, we documented some stylized facts on the characteristics of the microfinance industry and the macroeconomic environment in Sub-Saharan Africa (SSA). We found that the credit growth of MFIs in SSA is rapid and the microfinance industry is highly capitalized. Micro-banks have the highest portfolio quality; whereas, rural banks have the lowest portfolio quality. Southern and eastern Africa MFIs have better portfolio quality than western and central Africa MFIs. The MFIs in SSA are not

profitable. Additionally, MFIs organized as rural banks are most liquid; on the other hand, MFIs MFIs organized as NGOs and NBFIs are least liquid. The deposit growth of MFIs is rapid and the microfinance industry is growing fast (in six years time from year 2004 to 2010, the size of MFIs has increased to more than five-fold). Nevertheless, we found that non-deposit borrowing is not a stable source for MFI funding.

Furthermore, the One-Way ANOVA and the multiple linear regression results show that while the magnitude of credit growth, deposit growth and non-deposit borrowing growth is similar by sub-region, the level of capitalization, portfolio quality, profitability, liquidity and deposit mobilization of MFIs significantly varies across legal status and sub-regions. Specifically, MFIs operating in central Africa as well as MFIs organized as rural banks were most liquid; on the other hand, MFIs operating in western Africa and MFIs organized as NGOs were least liquid. We also document that while MFIs organized as rural banks were most profitable, those organized as NGOs were the most unprofitable MFIs.

The findings also show that MFIs operating in central Africa and MFIs with rural bank legal status have high deposit mobilization (as measured by the deposits to assets ratio) whereas MFIs organized as NGOs and MFIs operating in southern Africa have low deposit mobilization. Additionally, we found that legal status has significant effect on credit growth and deposit growth of MFIs; however, it has no influence on non-deposit borrowing growth. Most importantly, we found new evidence that location has a moderating effect on the relationship between the financial performance and legal status of MFIs within SSA. The empirical results support, to a certain extent, the agency theory

which implies that since agency costs may be higher in NGO MFIs than micro banks and NBFIs due to the lack of real owners, monitoring and oversight of executive by the board, NGO MFIs could be inefficient; however, how far worse NGOs perform (at least in terms of profitability) still depends on the location of MFIs.

Finally, we documented that the economy of African countries is growing on average by about 5.9 percent. This is encouraging especially since African countries have been able to sustain their economic growth and the GDP growth is steady. However, the economic growth is largely driven by inflation. The inflation rate in SSA economies had been on average of around 8.3 percent. This implies that people who have already acquired assets and are relatively rich will continue to be wealthy and those who have no assets continue to be poor. We also reported that there are some improvements in employment opportunities and income per capita from time to time in countries of SSA.

CHAPTER 6: RESULTS AND DISCUSSIONS: WHAT DRIVES MFI LENDING BEHAVIOR IN SUB-SAHARAN AFRICA?

6.1 Introduction

In this chapter we first discuss the empirical findings on the drivers of MFIs' lending behavior; we discuss further the results on the relationship between lending behavior and capital adjustment process in a subsequent section[28]. The analysis is based on data on 31 countries[29] in SSA. Although there are 48 countries in SSA according to the World Bank classification, the remaining countries either do not have MFIs or the MFIs do not submit data to the MIX Market (or data are incomplete). The distribution of the sample MFIs by sub-region and legal status is summarized in Table 10.

Table 10: *Sub-Saharan Africa MFIs: Sample Distribution*

Category	Group	No. of MFIs	No. of Observations	Countries Included
Sub-Regions[a]	Eastern Africa	37	315	MFIs from Ethiopia, Kenya, Rwanda, Tanzania, and Uganda
	Western Africa	63	500	MFIs from Benin, Burkina Faso, Cote d'Ivoire (Ivory Coast), The Gambia, Ghana, Guinea, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo
	Central Africa	16	140	MFIs from Burundi, Cameroon, Central African Republic, Chad, DR Congo, and Congo
	Southern Africa	22	183	MFIs from Angola, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, and Zambia
Charter Type[b]	Bank	13	118	
	NBFI	41	331	
	Credit Unions	36	306	

[28] This section is derived mainly from articles subsequently published in *International Journal of Emerging Markets* on 5 July 2021 copyright Emerald Publishing Limited, available online: https://doi.org/10.1108/IJOEM-08-2020-1002 and *Cogent Economics & Finance* on 16 Aug. 2022, copyright Taylor and Francis, available online: https://doi.org/10.1080/23322039.2022.2111791

[29] The lists of countries included in our analysis comprise Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the, Congo, Republic of the, Cote d'Ivoire (Ivory Coast), Ethiopia, Gambia, The, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda and Zambia.

	NGO	41	350	
	Rural Bank	7	33	

[a]We adopt the sub-regional classifications used by MIX & CGAP (2010). Sub-regions of Namibia and Cote d'Ivoire (Ivory Coast) are based on UNICEF sub-regional classifications since they were not included in the former source.

[b]The categorization of charter type is based on the MIX Market definition.

6.2 Econometric Results

Given the crucial role of lending behavior in the financial sustainability of MFIs, poverty eradication, and macro-economic stability, this study aimed at identifying the drivers of the credit growth of MFIs in SSA. In examining the determinants of MFI lending behavior, we relied on unbalanced panel dataset of 130 MFIs operating across 31 countries during the period 2004–2014 constituting 546 usable observations as a basis for the econometric analysis. The results from the two-step system-GMM (short run effects) are summarized in Table 11 below.

The first column displays the results for our benchmark model and the second drops deposit growth and non-deposit borrowing growth from the benchmark model since the first regression model show that these variables are not important determinants of loan growth and hence, their inclusion may increase the standard errors. Moreover, because of MFIs with no financial intermediation, we are able to increase the number of observations when we drop the variable “deposit growth”, thereby achieve increased efficiency. The third extends column two by controlling for regulation and profit status. The fourth column controls for legal status by replacing regulation and profit status in column three as they are likely to be collinear with MFI legal status and the last column extends the fourth column by controlling for the effect of MFI location. In Table 12, we

replace Table 11 with the long-run elasticities of MFI lending with respect to the predictor variables based on the Delta method.

In all GMM models (Model 1–5), the Sargan test fails to reject the null hypothesis (the instruments are uncorrelated with residuals), and, therefore, the over-identifying restrictions are valid. Since the first difference of idiosyncratic errors will be serially correlated, rejecting the null hypothesis of no serial correlation in the first-differenced errors at order one does not imply that the model is misspecified. However, rejecting the null hypothesis of no second-order serial correlation of the residuals implies that the moment conditions are not valid. In our case, in all models, the test results suggest that there is no autocorrelation in the residuals as reflected by the *p*-values of the AR(1) and AR(2) at the 95 percent confidence interval. Bond (2002) assertion that the first-differenced residuals exhibit a negative first order serial correlation if there is no serial correlation in the idiosyncratic errors while levels residuals show a positive serial correlation due to the presence of the individual effects is also confirmed.

In using GMM estimator, another concern is instrument proliferation problem: "… too many instruments can over-fit endogenous variables and fail to expunge their endogenous components" (Roodman, 2007, P.43). Accordingly, Roodman states that one rule of thumb is to check whether the instrument count is greater than the number of groups, N, although this approach may be too liberal; if so, then test the robustness of the results to reducing it using options such as collapsing instruments in xtabond2, and limiting the lags used in GMM-style instruments. In our case, instrument proliferation is not a problem for two reasons. The first is we use a short panel data (few time periods and

many individuals) and instrument proliferation is less likely to be a concern in panel data with short time series dimensions. Second, the number of instruments (52) is significantly lower than the number of groups (130) and hence, instrument proliferation problem is not a concern in this study.

In all GMM models (i.e. Model 1–5), the Wald statistic is statistically significant at 1% percent level of significance suggesting that the variables included in each of our econometric models are jointly significant to explain MFI lending behavior. The results are generally in line with our expectations. The relative magnitude of influence and the statistical significance of the MFI specific and macro-economic factors are also more or less preserved in all regression models indicating that the results are robust**.**

Table 11: *Dynamic Panel Regression Results: Drivers of MFI Lending Behavior*

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Credit Growth (LB): Dependent Variable					
Credit Growth (Lag)	**0.1629****	**0.1563****	**0.1539****	**0.1463****	**0.1309***
Capitalization $(CATR)_{t-1}$	**0.5813****	**0.6226****	**0.5922****	**0.5797****	**0.5702****
Profitability $(PROF)_{t-1}$	**-1.1807***	**-1.285*****	**-1.3314*****	**-1.3359*****	**-1.28*****
Portfolio Risk $(RISK)_{t-1}$	**-0.1018**	**-0.3882**	**-0.4541**	**-0.5045**	**-0.5988**
Liquidity $(LIQ)_{t-1}$	**0.9064****	**1.1306*****	**1.0781*****	**1.0111****	**1.068*****
Size $(LNTA)_t$	**0.4161*****	**0.4929*****	**0.5165*****	**0.51*****	**0.4827*****
Deposit Growth $(DEPG)_t$	**0.0725**				
Non-deposit borrowing Growth $(FUNG)_t$	**0.00514**				
GDP Growth $(GDPG)_t$	**1.2257**	**1.8056****	**1.772****	**1.7876****	**1.7486****
Inflation $(INF)_t$	**.6342***	**0.3623**	**0.2839**	**0.1988**	**0.2779**
Employment $(EMP)_t$	**-1.8298**	**-0.1408**	**1.4164**	**1.2302**	**-1.0465**
GDP per Capita $(CUP)_t$	**-0.4503****	**-0.694*****	**-0.8056*****	**-0.8564*****	**-0.6852****

Large Scale $(LSCA)_{t-1}$	**-0.3608*** **	**-0.4063*** **	**-0.3829*** **	**-0.3599*** **	**-0.348*** **
Small Scale $(SSCA)_{t-1}$	**0.3965*** **	**0.3677*** **	**0.3737*** **	**0.3788*** **	**0.366*** **
Financial Crisis (GFC2008)	**-0.1617***	**-0.1264***	**-0.0987**	**-0.0722**	**-0.1066**
Financial Crisis (GFC2009)	**0.0093**	**0.0341**	**0.0395**	**0.0433**	**0.0388**
Regulation			**-0.3535**		
Profit Status			**0.5419**		
Bank[a]				**-0.4303**	**0.2605**
Rural Bank[a]				**3.2767**	**7.5972**
Credit Unions/Cooperatives[a]				**-1.219**	**0.963**
NGOs[a]				**-0.3074**	**-0.2948**
Western Africa[b]					**-1.5854**
Central Africa[b]					**-3.1471**
Southern Africa[b]					**-1.011**
Constant	**-2.7661**	**-3.5572***	**-4.155***	**-3.199**	**-1.779**
Wald Test	chi2(16)= 134.61 Prob>chi2=0.0000	chi2(14)=193.11 Prob>chi2=0.0000	chi2(16)= 204.12 Prob>chi2=0.0000	chi2(18)= 294.91 Prob>chi2=0.0000	chi2(21)= 315.57 Prob>chi2=0.0000
Sargan Test[c]	chi2(37)=35.51062 Prob>chi2= 0.5389	chi2(37)=34.05247 Prob>chi2=0.6080	chi2(35)=33.33005 Prob>chi2=0.5488	chi2(33)=33.0872 Prob>chi2=0.4630	chi2(30)=30.7522 Prob>chi2=0.4277
AR(1)[d]	z= -2.513 Prob > z=0.0120	z= -2.6691 Prob > z= 0.0076	z= -2.6582 Prob > z=0.0079	z= -2.7506 Prob > z=0.0059	z= -2.6996 Prob > z=0.0069
AR(2)[d]	z= 1.4082 Prob > z=0.1591	z= 1.5055 Prob>z= 0.1322	z= 1.5054 Prob> z= 0.1322	z= 1.4837 Prob > z=0.1379	z= 1.4635 Prob > z=0.1433
Observations	501	546	546	546	546
No. of groups	125	130	130	130	130
No. of instruments	54	52	52	52	52

[a] These indicators represent legal status of MFIs where NBFIs are the benchmarks; [b] These are indicator variables reflecting the sub-region where the MFIs are operating where the benchmark sub-region is Eastern Africa; [c]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [d]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. *** show significance at 99 percent confidence interval; ** indicate significance at 95 percent confidence interval and * reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

6.2.1 MFI specific determinants of lending behavior

In this section, we discuss the GMM results (Table 11) on the short-run effects of MFI-specific factors, namely capitalization, profitability, risk, liquidity, size, deposit growth, and non-deposit borrowing growth on lending behavior of MFIs in SSA. In subsequent sections, we discuss the macroeconomic and other determinants of MFI lending behavior. The results show that capitalization, profitability, liquidity and MFI size are the main MFI specific determinants of credit growth; whereas, portfolio quality, deposit growth and non-deposit borrowing growth have no significant impacts on MFI loan growth.

We found new and interesting finding that credit growth is negatively related to profitability. The findings establish that more profitable MFIs are more risk averse and cautious in extending credit. Accordingly, MFIs that are more profitable at time *t-1* reduce their credit growth at time *t* may be in order to limit portfolio risk and maintain their profitability since, consistent with the literature (Muriu, 2011; Tehulu, 2013), credit risk impacts profitability negatively. This shows that profitable MFIs make a balance between sustainability and social missions (outreach). The result is significant at 1 percent level of significance (regression models2–5).

Our findings seem to be at variance with the direct association of profitability with loan supply that has been documented in Hessou and Lai (2018). In their study of "Basel III capital buffers and Canadian credit unions lending: Impact of the credit cycle and the business cycle", Hessou and Lai found that profitability (measured by return on assets (ROA)) at time *t-1* is followed by more loan granting at time *t*. Hessou and Lai explain

this positive relationship as follows: In MFIs which are particulary mutually owned ones such as credit unions, dividends paid to members store up in saving accounts and available for granting new loans.

Hessou and Lai also argue that credit unions also adjust capital buffers by retaining earnings; this could lead to the positive association of profitability with lending. However, since credit unions usually require cash collateral, credit expansion does not raise risk management issues. In other MFIs, since credit expansions may lead to defaults, those MFIs that are more profitable at time *t-1* may choose to limit their lending in order to reduce defaults and maintain their profitability. Conversely, MFIs that are less profitable have higher credit growth either because these MFIs take more risks and expand credits as a last resort to make profits and ensure the sustainability of the institution (Igan & Pinheiro, 2011) or because these institutions focus more on their social missions rather than financial sustainability and therefore, focus more on credit expansions and by extension, outreach.

Contrasting empirical findings from the banking industry include Igan and Pinheiro (2011) and Laidroo (2012) that show a positive association between lending and profitability. In studying the two way relationship between credit growth and bank soundness, Igan and Pinheiro (2011) uncovered that profitability (as measured by net interest margin) is positively associated with loan growth. Similarly, Laidroo (2012) examined drivers of lending growth and cyclicality in banks and confirms that banks with higher profitability (as measured by net interest income to average total assets) grant more loans. This may be due to the fact that while the banking industry is a profit

motivated financial industry and requires collateral for the loans, the microfinance industry has to achieve the twin missions of financial sustainability and poverty reduction and may not hold tangible collaterals for the loans. Accordingly, since credit risk may not be a critical obstacle to profitability in banks in comparison to MFIs, more profitable banks may expand credits to maintain their profitability.

To the extent that less profitable MFIs follow prudent risk management and appropriate loan pricing strategies, their lending behavior will not be detrimental to the achievement of their goals since they will be able to improve their profitability and, at the same time, expand their outreach to the poor. However, in the absence of the aforementioned strategies, such MFIs may suffer more from loan defaults which may severely affect their financial sustainability and their ultimate goal of achieving poverty reduction since financially unsustainable MFIs will fail to survive in the future.

Regarding capitalization, the results revealed that MFIs with higher level of equity to total assets at time *t-1* increase their lending more in the following year. In all GMM models (Model 1–5), the result is statistically significant at 95 percent confidence interval. The finding suggests that MFIs with greater retention of earnings and therefore higher capital would be better able to ease credit conditions for the poor. The economic significance of the effect of capitalization is also comparable to the one observed from the banking industry. While we find that a 1 percentage increase in the equity ratio leads to a 0.5702 to 0.6226 increase in annual credit growth, Gambacorta and Shin (2018) documents that a 1 percentage increase in the equity-to-total assets ratio is associated with a 0.5997 percentage increase in annual loan growth.

The result is consistent with the prior empirical evidences from the banking industry that document a positive association between bank lending behavior and capitalization (Gambacorta & Mistrulli, 2004; Berrospide & Edge, 2010; Covas, 2016; Gambacorta & Shin, 2018). The findings could show that MFIs with poor capitalization limit their loan supply in order to meet regulatory capital requirements as it may be difficult to obtain public or private equity capital.

Since the microfinance industry is diverse in status comprising both regulated and unregulated MFIs, the finding also supports Thibaut and Mathias (2014) who argue that even when regulatory capital requirements are not binding, financial institutions could be capital constrained to expand credits due to market discipline and, therefore, MFIs with lower capitalization could be more risk averse and limit their loan supply in order to fulfill market constraints since the market (including institutional and retail depositors) requires adequate capitalization for the risk the financial institution assume; the level of capitalization is a good indicator of MFI solvency and creditors/depositors do not want to lend money to financially less solvent MFIs.

In addition, the degree of persistency of credit growth reported earlier implies that there is competition (though, less strong) in the credit market of the microfinance industry in Africa. This implies that MFIs with higher equity ratio take advantage of their capitalization to expand credits since MFIs are likely to be productive in competitive markets. In regulated MFIs, one of the regulation areas is reserve requirement. While deposits are subject to reserve requirement, equity capital is not. Therefore, MFIs with

higher capital ratio could have more loanable funds which in turn allow expanding credits. The result, however, contradicts with Cucinelli (2016) that show a negative association of equity ratio with bank lending behavior; Cucinelli asserts that banks with higher capitalization could be risk averse and follow a more conservative credit policy.

The significant positive association of capitalization with MFI credit growth obviously confirms that certain MFIs in SSA are capital constrained. Although MFIs in SSA had been highly capitalized during the period under investigation, in the future, as MFIs grow larger as well as get more livered, the microfinance industry in SSA could face significant capital constraint to sustain its rapid credit growth. Moreover, since the microfinance industry in SSA is unprofitable, capital adjustment may be difficult and capital constraint could be a serious impediment to the credit growth of MFIs.

As stated in Chapter 1, one of the objectives of this study was to examine the effect of capitalization on MFI credit growth using two frameworks. The first is whether capitalization affects lending behavior directly through the capital ratio, which is the one discussed above. The second is whether capitalization impacts loan growth through the deviation (i.e. divergence between the actual capital ratio and the implicit target capital). Accordingly, in chapter six, we discussed further whether capitalization affects MFI credit growth through the deviation (i.e. capital surplus/shortfall) and whether it has non-linear effect as well.

In all GMM models, the findings on the portfolio risk–lending nexus confirm the expected sign. A reduction in portfolio quality is associated with a decrease in the growth

of gross loan portfolio. However, the result is not statistically significant. Therefore, the results show that MFIs with higher portfolio risk at time *t-1* reduce their credit growth at time *t* but not significantly. In other words, given the present realities of MFIs in SSA, the results establish that portfolio risk have little effect in expanding credits and hence, outreach. This implies that MFIs with higher portfolio risk in the current period either they are willing to take the risk and bet all their resources in a last effort to survive (Igan & Pinheiro, 2011) or these MFIs focus more on their social mission rather than financial sustainability and hence, try to maintain their credit growth.

The result is not consistent with the empirical evidences from the banking industry (Tomak, 2013; Karmakar & Mok, 2013; Cucinelli, 2016) that document a significant negative relationship between lending behavior and risk. The banking industry is guided by profit motive. Consequently, banks with higher portfolio risk could expand credits less to limit portfolio risk since deterioration in portfolio quality impacts their profitability negatively. However, unlike banks, MFIs have to achieve the goal of financial sustainability on the one hand and poverty reduction on the other hand.

Accordingly, since the microfinance industry in SSA focuses mainly on poverty reduction rather than financial sustainability, MFIs with higher credit risk do not reduce their credit growth significantly since they have to increase access to credit to the poor. To test the sensitivity of the result to an alternative measure of risk, we also dropped portfolio risk and added loan loss provisions as an alternative credit risk measure and examined if the loan loss provisions could predict lending behavior; however, the loan loss provisions also fails to be a determinant of MFI credit growth.

Although the GMM results establish that portfolio risk has little direct effects on MFI credit growth, our correlation matrix (Table B) and our results in Section 6.3 show that credit risk could have indirect effects on the lending behavior of MFIs by depleting capital as a higher portfolio risk implies higher loan loss provision expense which in turn negatively affects profitability, and thereby reducing MFI capitalization. Given the prior empirical evidences that show profitability is negatively related to the credit risk of MFIs (Muriu, 2011; Tehulu, 2013) and our findings in Section 6.3 that portfolio risk depletes capital even after controlling for profitability, we suggest that proper risk management strategies and practices are vital not only in the financial sustainability of MFIs but also in sustainable poverty alleviation though expansion of credit access for the poor since financially unsustainable (Schreiner, 2000) and/or insolvent MFIs will fail to survive in the long term.

Consequently, MFIs with poor portfolio quality will fail to achieve their goals of financial sustainability and social impact in the long term. Since the use of credit bureau information in selecting new clients enhances portfolio quality (McIntosh, Sadoulet & de Janvry, 2006[30]; Soedarmono & Sitorus, 2017[31]), we advocate the establishment or strengthening of credit bureaus in order to help MFIs improve their portfolio quality, and thereby achieve their dual missions, as most countries in Sub-Saharan Africa lack credit information bureaus which could help to reduce loan defaults (Mylenko, 2008)..

[30] The study shows that after MFIs began use of credit bureau information in selecting new clients, "the average percentage of individual loans with at least one late payment decreased from 67.2% for pre-credit bureau loans, to 52.8% for post-credit bureau loans" (P.2).

[31] This study revealed that better credit information coverage and private credit bureaus can mitigate the buildup of bank systemic risk one year ahead.

As expected, in all regression models, the cogefficient of liquidity is positive and statistically significant at least at the 5 percent level indicating that liquidity has a positive association with credit growth. This result implies that MFIs with more liquidity at time *t-1* are likely to grant more loans at time *t*. In order to understand the crucial role of liquidity on MFI lending behavior, it is vital to compare the effect of liquidity with the effect of capitalization; the results show that the effect of liquidity has higher relative economic importance. It appears that a 1 percentage change in liquidity has a higher effect on the fluctuations of credit growth in comparison to the effect of a 1 percentage change in capitalization (1.1306 Vs 0.6226 in model 2 for instance).

The finding is in line with the literature (Hessou & Lai, 2018; Gambacorta & Mistrulli, 2003; and Berrospide & Edge, 2010) that revealed lending is positively related to liquidity. Given that we measure liquidity by using the non-earning assets as a percentage of total assets (i.e. cash and cash equivalents compared to total assets including short-term investments), the finding shows that MFIs with higher liquidity in any one fiscal year could be able to shield their lending against shocks to the availability of external finance in the following year since deposit mobilization is difficult in the microfinance industry. This view is in line with Laidroo (2012) that argues that higher liquidity could allow financial institutions to grant more loans as the lending behavior of such financial institutions could be less vulnerable to economic shocks and shocks to their deposits.

The positive association between loan growth and liquidity could also show that MFIs with higher liquidity could sell their securities to meet their funding needs for making

new loans (Berrospide & Edge, 2010). Therefore, MFIs with higher liquidity are better able to accommodate withdrawal and loan demands effectively. The result may also be due to the fact that regulatory authorities have lower capital requirement for more liquid MFIs since more liquid assets receive lower risk weights. The lower capital requirement allows them to have more capital buffer to expand credits more. More liquid MFIs also have higher ability to meet interest and principal payments. Hence, these institutions are chosen by their creditors and this allows those MFIs to increase leverage and grant more loans.

Nevertheless, previous research also documents contrasting evidence (Cucinelli, 2016) while Olokoyo (2011) reports an insignificant effect of liquidity on lending behavior. The contrasting finding in Cucinelli (2016) could be explained by considering how they measured liquidity; they use total securities to total asset ratio as proxy for liquidity, which, however, captures investment activities other than lending rather than liquidity. Consequently, depending on investment choices, liquidity (as measured by securities to total assets) could have negative or positive effect. In this regard, Berrospide and Edge (2010) found that liquidity (as measured by securities-to-assets ratio) has a positive effect on loan growth; this contradicts with the finding of Cucinelli (2016). It implies that when the preferred asset category is the loan, financial institutions could sell their securities to meet their funding needs for making new loans. When banks consider loans too risky, they could invest the funds in securities.

The stylized facts described in Section 5.2.1 revealed that the non-earning asset as a percentage of total assets, which is a measure of liquidity, was more or less stable at an

average of about 21 percent over the period considered. However, the standard deviation, which is 15 percent, has also shown that the variability in liquidity among MFIs had been significant. In the same section, we also reported that MFIs operating in central Africa as well as MFIs organized as rural banks were most liquid; on the other hand, MFIs operating in western Africa and MFIs organized as NGOs and NBFIs were least liquid. This implies that, since any institutional depositors could withdraw substantial amount of funds at any given time (CGAP, 2010) and given the rapid credit growth of MFIs and the high reserve/liquidity requirement in some MFIs (eg. MFIs in Ghana and Ethiopia), certain MFIs could face liquidity problem to meet withdrawal and loan demands if they cannot expand their funding base since it may be difficult to secure adequate funds especially during periods of weak economic conditions.

The size of MFIs exhibits a positive association with loan growth controlling for scale effects. We control for scale effects since the computation of credit growth uses the lag value; MFIs with small gross loan portfolio at time *t-1* are likely to have higher credit growth at time *t* which may distort the true effect of size. In all GMM models, the result is significant at 99 percent confidence interval. Size influences MFI's credit supply positively possibly because large MFIs have more loanable funds to support their desired higher credit growth (Hessou & Lai, 2018). Large MFIs could also enjoy diversification and economy of scale compared to small MFIs (Aggarwal & Jacques, 2001). Moreover, bigger financial institutions also have lesser information asymmetries (Laidroo, 2012) and stronger risk management culture (Hessou & Lai, 2018).

The result may also be explained by the "Too big to fail hypotheses". Due to the vital role of large financial institutions in the economy and hence, the protective policies, bigger MFIs may engage in moral hazard behavior and expand credits more by assuming more risk. The findings imply that if MFIs are able to increase their size by attracting more deposits, raising/obtaining equity capital and non-deposit borrowings, they can increase credit access to the poor. While previous empirical evidences on the relationship between credit growth and firm size are inconclusive (Aydin, 2008; Matousek & Sarantis, 2009; Laidroo, 2012; Thibaut & Mathias, 2014), our findings confirm Aydin (2008) who found that bank size positively impacts credit supply.

The coefficients for deposit growth and non-deposit borrowing growth are positive, but statistically insignificant (Model 1). This does not imply that deposit growth and non-deposit growth are not important factors in the lending behavior of MFIs. When we consider model 2, when both variables are omitted from the regression equation, the economic importance of liquidity and size is improved. Hence, although deposit growth and non-deposit borrowing growth do not have a significant direct impact on MFI credit growth, both factors could affect the lending behavior of MFIs by influencing the level of liquidity and size of MFIs.

Nevertheless, the results are not in line with the literature which documented that deposits (Olokoyo, 2011; Laidroo, 2012; Cucinelli, 2016) and non-deposit borrowings (Wagner & Winkler, 2012) have significant direct effects on the lending behavior of financial institutions. Finally, the results reveal that the sign of scale dummies is as expected and statistically significant at 1 percent level of significance in all models. While lower gross

loan portfolio (GLP) in the preceding year amplifies the magnitude of the current credit growth rate, higher GLP reduces credit growth rates.

6.2.2 Macroeconomic factors and lending behavior

The results also show that in addition to MFI specific factors, macroeconomic factors also play a vital role in the lending behavior of MFIs. In all GMM models except model 1, we find GDP growth is positively associated with credit growth at 5 percent level of significance. This shows MFIs' lending behavior is not resilient to GDP shocks. This phenomenon could be explained as follows: First, when national income increases, consumption will also increase which leads to more investment opportunities since business firms now have a recipient market for their goods and services which in turn increases the demand for loan. This pro-cyclicality of demand for loans makes the credit growth of MFIs pro-cyclical.

Second, given that portfolio risk in financial institutions is counter-cyclical (Bikker & Metzemakers, 2005; Glen & Mondragón-Vélez, 2011), during economic upturns, MFI clients could have more ability to repay their debt and hence, MFIs could be optimist to expand credits. Conversely, during economic downturns, borrowers will face financial constraints to repay their debt and therefore, MFIs could follow strict credit standards and reduce their credit growth to limit portfolio risk and enhance their profitability.

Since the economic growth of countries in SSA is fast and stable, the findings show that the GDP growth has contributed for the rapid credit growth of MFIs in SSA and hence, to the attainment of the dual goals of financial sustainability and poverty reduction as the

loan portfolio constitutes the highest earning asset in the portfolio of MFIs and access to credits from MFIs help the poor to acquire assets and start producing and selling goods and services to enhance their income and hence, benefit from the economic growth. Considering the magnitude of the coefficient of GDP growth, one may tend to conclude the business cycle has the highest economic significance. However, its economic importance could be limited given the actual changes in GDP growth a country could achieve in any one year.

Furthermore, the findings revealed that the lending behavior of MFIs is more resilient to GDP shocks compared to bank lending behavior. While our findings reveal that a 1 percentage decrease in GDP growth entails a 1.7486 to 1.8056 percentage reduction in MFI credit growth, Berrospide and Edge (2010) found that a 1 percentage reduction in GDP growth leads to about a 4 percentage decline in annualized bank loan growth. Nevertheless, the results are in line with the literature from the banking industry (Bikker & Hu, 2002; Gambacorta & Mistrulli, 2004; Quagliariello, 2007; Berrospide & Edge, 2010; Igan & Pinheiro, 2011; Laidroo, 2012) which documented that bank lending is pro-cyclical.

The pro-cyclicality of MFI lending, however, implies that a negative shock to GDP growth is detrimental to MFI credit growth. Therefore, the findings suggest that different measures are needed to increase the financial stability of the microfinance industry. Our findings have substantial policy implication; specially, in the future when the microfinance industry grows larger as well as faces significant capital constraints as they

get more levered, the finding implies that central banks should impose a counter-cyclical capital buffer requirement on MFIs.

Given that credit risk is counter-cyclical, an increase in portfolio risk during economic shock depletes capital which in turn forces MFIs to reduce their credit growth. The reduction of credit growth due to both capital constraint and GDP shock in turn worsens the nation's economy putting MFI lending behavior and the economy in a vicious circle. These cycles will continue to exist until an external factor intervenes and breaks the cycle. Accordingly, the purpose of counter-cyclical capital buffer requirement could be three-fold: One is to increase the solvency of MFIs and help them better able to absorb losses and still continue their normal business operations as well as meet the capital requirements.

The second is, the introduction of counter-cyclical capital buffer requirement allows MFIs to grant more loans during an economic downturn, and thereby increase aggregate demand and contribute to economic recovery turning the vicious cycle into a virtuous cycle. Third, since one of the dual goals of MFIs is to achieve poverty reduction (i.e. social impact) by providing credit access to the poor, the microfinance industry could face excess credit growth during upturns compared to bank credit growth and hence, the counter-cyclical capital buffer requirement could protect the microfinance sector from periods of excess credit growth that may lead to systemic risk.

On the other hand, we expect that the effect of GDP growth could be asymmetric depending on the level of capitalization. Accordingly, in chapter six, we also examine

whether the lending behavior of undercapitalized MFIs is more pro-cyclical. As to the effect of inflation, the results in Table 11 show that the coefficient of this variable is positive in line with theoretical expectations, but statistically insignificant with the exception of model 1. This suggests that inflation drives MFI credit growth positively. Nevertheless, when countries experience higher inflation, MFIs clients (i.e. borrowers) could face financial constraints to make their livelihoods as well as repay the debt. Hence, effectively, there would not be significant increase in demand for loans from microfinance institutions when there is higher inflation since the poor will be unable to repay the debt.

In this regard, comparative evidences from the banking industry reveal mixed evidences; while Gambacorta and Mistrulli (2003; 2004); Laidroo (2012) and Thibaut and Mathias (2014) uncovered a positive association and Cucinelli (2016) revealed a negative relationship, Berrospide and Edge (2010) found that inflation has no significant effect on loan supply. While the effect of employment is statistically insignificant, the sign is also not conclusive; in some models it is negative, in other models it is positive.

Finally, Table 11 shows that GDP per capita has a significant negative effect on MFI credit growth. In all GMM models (Model 1–5), the results are statistically significant at least at 5 percent level of significance. This finding is consistent with the theory of convergence, which is predicated in part on the law of diminishing marginal returns, and implies that poorer economies tend to grow more rapidly than wealthier economies and hence, poorer countries have higher demand for credits which translates into higher credit growth in these economies. The result corroborates Igan and Pinheiro (2011) and

Wagner and Winkler (2012) who found that financial institutions in richer countries have lower credit growth than financial institutions in poorer countries.

6.2.3 Other determinants of lending behavior

In all GMM models except model 1, the coefficient of crisis dummies are not statistically significant. The average credit growth was 63.67 percent during the year 2007 and 28.89 percent during the year 2008. These evidences suggest that although there had been significant decline in credit growth during the global financial crisis (specifically, during the year 2008), the decline might have been due to shocks to the included firm specific and macroeconomic variables caused by the global financial crisis or some other factors. A closer look at Figure 1, Figure 2, and Figure 3 (in Section 5.2) reveals that the decline in MFI funding (i.e. decline in deposit and non-deposit borrowing growth) during the global financial crisis, specifically the year 2008, seems to have significantly affected the size (growth) of MFIs as well as MFI liquidity, and thereby negatively impacted the credit growth of MFIs in SSA during the same year.

As to the effect of charter types, though the One-Way ANOVA and simple OLS regression results discussed earlier in section 5.2 show that credit growth varies across legal forms of MFIs, the GMM results reveal that legal statuses have no effects on the loan growth of MFIs when we control for MFI specific and macroeconomic factors. This implies that the MFI specific drivers of credit growth mediate the relationship between credit growth and legal status. Comparative empirical evidence on the effect of legal status on credit growth is missing. Consistent with cross-country evidence on the impact of regulation on MFI performance (Hartarska & Nadolnyak, 2007), we also find no

evidence to support an association between MFI credit growth and regulation status. Similarly, the profit status of MFIs has no significant direct effect on the credit growth of MFIs.

Since the inclusion of MFI specific variables may absorb the predictive power of regulation/profit status, empirical research is, however, needed to test the effect of regulation/profit status on credit growth without controlling for the MFI specific factors. Finally, consistent with the One-Way ANOVA and OLS regression results discussed in section 5.2, we uncover that the location or sub-region of MFIs is not an important factor in explaining MFI credit growth.

6.2.4 Persistence of credit growth and speed of convergence

In the first four regression models (Model 1–4), the coefficient of the lagged credit growth (i.e. the lagged dependent variable) is significantly different from zero at 5 percent level of significance while it is statistically significant at 10 percent in Model 5. The results imply that there is persistency in microfinance credit growth in Sub-Saharan Africa. In other words, the findings establish that a shock to loan supply in the current year will have a significant effect on loan supply in the following year. However, the departure from perfect competition is only marginal as the speed of adjustment is between 83.71 and 85.37 percent. The results show that when there are shocks (positive or negative) to credit growth at a given year, the credit growth will adjust fast to its equilibrium level in the following year.

The findings confirm that there is less intense competition in the credit market of MFIs in SSA. The idea behind this point is that when competition is intense, there is likely to be little persistency (Kaplan & Aslan, 2006). MFIs with above average credit growth in one period will not be able to maintain the same level of credit growth in the subsequent periods, as it will be eroded by competitors and hence, credit growth of competing MFIs will not be persistent. Conversely, if competition is less intense, credit growth differences between MFIs may be expected to be persistent; MFIs with above average credit growth will be able to maintain the same level of credit growth in the subsequent periods implying the presence of persistence of credit growth. The existence of persistency in credit growth may be due to the persistency of market power and/or the persistency of productivity in the credit market of the microfinance industry in Africa.

In this regard, Carlson et al. (2018) documented that incumbent banks operating in more competitive markets increase their loans and deposits portfolio at a rate 22 percentage points higher than their peers in less competitive markets implying banks with more market power limit credit provision. Furthermore, Carlson et al. (2018) establish that while banking competition could contribute to credit expansion, it may also lead to financial instability as it increases bank risk-taking. Similarly, Kabir and Worthington (2017) found that market power increases bank stability.

The literature from the microfinance industry also establishes that higher competition could lead to higher portfolio at risk and higher levels of loan write-offs implying that "competition leads to multiple-loan taking by clients, resulting in heavy debt burdens and low repayment rates" (Assefa , Hermes , & Meesters , 2013, P.779). Competition could

also lead MFIs to relax credit standards and reduce costly monitoring and screening procedures as it puts pressure on MFIs to increase loans and lower costs (McIntosh & Wydick, 2005 and McIntosh et al., 2005 cited in Assefa et al., 2013). The findings by Kar and Swain (2014) also confirm that competition in the microfinance industry is negatively associated with loan portfolio quality.

Therefore, the existence of slight persistency in credit growth and hence, less intense competition in the microfinance industry in SSA could constrain credit provision but has the advantage of supporting financial stability. Given that the level of competition sought requires a trade-off between credit expansion and financial stability, government policies shall prioritize the need for credit expansion versus MFI stability and determine the need for fostering competition versus introducing new barriers to competition (for example, through capital requirements) accordingly.

6.2.5 Long-run determinants of credit growth

In this section, we replace the results in Table 11 (short-run effects) with the long-run effects of the independent variables on the outcome variable (credit growth). The long-run elasticities are calculated by dividing their respective coefficients in Table 11 by the speed of adjustment of credit growth. For example, the long-run coefficient for capitalization is calculated as:

$$\psi / (1 - \beta_1)$$

Where ψ is the estimated coefficient for capitalization, β_1 represents the degree of persistency in credit growth and (1- β_1) is the speed of adjustment in credit growth. Standard errors for the long-run effects have been approximated with the Delta method.

The results show that, capitalization, profitability, liquidity, size and scale of MFIs significantly explain lending behavior while portfolio quality, deposit growth and non-deposit growth have little effects on credit growth of MFIs in the long run consistent with the short run relationships. We also find that, in the long run, while MFI loan supply is pro-cyclical and GDP per capita is negatively associated with credit growth, inflation and employment have no significant influences on MFI lending behavior (Table 12). In all models, the statistical significance of the predictor variables is consistent with the short-run results. However, the results reveal that the predictor variables have higher economic significance compared to the short run effects for the obvious reason that credit growth is persistent.

Table 12: *Regression Results: Drivers of MFI Lending Behavior (Long-run Relationships)*

Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Credit Growth (LB): Dependent Variable					
Capitalization (CATR)t-1	**0.6945****	**0.7379****	**0.6999****	**0.6791****	**0.6561****
Profitability (PROF)t-1	**-1.4106***	**-1.5231****	**-1.5736*****	**-1.5649*****	**-1.4758*****
Portfolio Risk (RISK)t-1	**-0.1217**	**-0.4601**	**-0.5366**	**-0.5909**	**-0.689**
Liquidity (LIQ)t-1	**1.0829****	**1.34*****	**1.2741****	**1.1844****	**1.2293****
Size $(LNTA)_t$	**0.4971*****	**0.5842*****	**0.6105*****	**0.5974*****	**0.5553*****
Deposit Growth (DEPG)t-1	**0.0866**				
Non-deposit borrowing Growth (FUNG)t-1	**0.0061**				
GDP Growth (GDPG)t	**1.4643**	**2.1402****	**2.0946****	**2.094****	**2.0121****

Inflation (INF)t	**0.7576***	**0.4294**	**0.3356**	**0.2329**	**0.3197**
Employment (EMP)t	**-2.186**	**-0.1669**	**1.6741**	**1.4411**	**-1.2041**
GDP per Capita (CUP)t	**-0.5379****	**-0.8226*****	**-0.9521*****	**-1.003*****	**-0.7884****
Large Scale (LSCA)t-1	**-0.4311*****	**-0.4816*****	**-0.4525*****	**-0.4216*****	**-0.4005*****
Small Scale (SSCA)t-1	**0.4737*****	**0.4358*****	**0.4417*****	**0.4438*****	**0.4215*****
Financial Crisis (GFC2008)	**-0.1932***	**-0.1499***	**-0.1166**	**-0.0846**	**-0.1227**
Financial Crisis (GFC2009)	**0.0111**	**0.0404**	**0.0466**	**0.0506**	**0.0446**
Regulation			**-0.4178**		
Profit Status			**0.6404**		
Bank[a]				**-0.5041**	**0.2998**
Rural Bank[a]				**3.8384**	**8.7417**
Credit Unions/Cooperatives[a]				**-1.4283**	**1.1081**
NGOs[a]				**-0.36**	**-0.3392**
Western Africa[b]					**-1.8243**
Central Africa[b]					**-3.6212**
Southern Africa[b]					**-1.1634**
Constant	**-3.3046**	**-4.2163***	**-4.911***	**-3.7479**	**-2.0473**

[a] They represent legal status of MFIs where NBFIs are the benchmarks; [b] These are indicator variables reflecting the sub-region where the MFIs are operating where the benchmark sub-region is Eastern Africa ; *** show significance at 99 percent confidence interval; ** indicate significance at 95 percent confidence interval and * reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

6.2.6 Robustness tests

To confirm the robustness of the main results in Table 11, we performed different robustness checks. First, we used different estimation methodologies and show that our results are robust (Table 13). In this regard, using the Hausman test, we made a choice between Fixed effects and the GLS random effects estimator. We found that the Fixed effects estimator is more appropriate (Table C in the Appendix). The F-test that all u_i=0 gives F(129, 447)=1.90, Prob > F=0.0000; this suggests that the Fixed effects estimator is

also more appropriate than the OLS estimator (Table D in the Appendix). Accordingly, we re-estimated our benchmark model (Model 2 in Table 11) using the Fixed effects estimator (Model 1 of Table 13 for the results).

In order to test the sensitivity of the results to different dynamic panel data estimation techniques, we also applied two-step Arellano-Bond dynamic panel-data estimation with Windmeijer bias correction, one-step Arellano-Bond dynamic panel-data estimation robust standard errors, and one-step System dynamic panel-data estimation robust standard errors. The results are shown in Model 2, Model 3, and Model 4 of Table 13, respectively. The results in these estimation methodologies as well as the Fixed effects estimator revealed that the results are robust; while capitalization, liquidity, size, and GDP growth are positively associated with credit growth, profitability, level of institutional and economic development (i.e. GDP per capita), and scale of MFIs have a significant negative influences on the credit growth of MFIs.

Nevertheless, while the effect of portfolio risk on credit growth is generally insignificant in dynamic models, its effect is statistically significant under the Fixed Effects estimator. This may be due to the larger number of observations in the Fixed Effects estimation while the dynamic models exhibit lower numbers of observations due to missing values since these models employ differencing.

Table 13*: Drivers of MFI Lending Behavior: Robustness to Different Estimation Techniques*

Variables	**Model 1**†	**Model 2**††	**Model 3**†††	**Model 4**††††
Credit Growth (LB): Dependent Variable				
Credit Growth (Lag)	**N/A**	**0.1137***	**0.0919**	**0.1618*****
Capitalization $(CATR)_{t-1}$	**0.3918***	**0.5808****	**0.5982*****	**0.635*****

Profitability $(PROF)_{t-1}$	**-1.2783*** **	**-1.2825*** **	**-1.3328*** **	**-1.2859*** **
Portfolio Risk $(RISK)_{t-1}$	**-1.4392*** **	**-0.5916**	**-0.8087***	**-0.5537**
Liquidity $(LIQ)_{t-1}$	**1.1713*** **	**1.0566*** **	**0.8924** **	**1.1296*** **
Size $(LNTA)_t$	**0.1872***	**0.4742*** **	**0.4474*** **	**0.4458*** **
GDP Growth $(GDPG)_t$	**1.4906***	**1.6466** **	**2.38*** **	**3.2018*** **
Inflation $(INF)_t$	**0.1819**	**0.272**	**0.3769**	**0.8144***
Employment $(EMP)_t$	**-1.0707**	**-0.962**	**-1.9321**	**-0.5527**
GDP per Capita $(CUP)_t$	**-0.41498***	**-0.688** **	**-0.8761*** **	**-0.6387*** **
Large Scale $(LSCA)_{t-1}$	**-0.4462*** **	**-0.3431*** **	**-0.3293*** **	**-0.3344*** **
Small Scale $(SSCA)_{t-1}$	**0.3714*** **	**0.3601*** **	**0.3548*** **	**0.3789*** **
Financial Crisis (GFC2008)	**-0.1605** **	**-0.105**	**-0.1431***	**-0.2208** **
Financial Crisis (GFC2009)	**-0.0006**	**0.0349**	**0.0096**	**0.0396**
Constant	**0.4867**	**-2.6883**	**-0.3288**	**-3***
Wald Test/F-Test	F(13,129)=4.21 Prob>F=0.0000	chi2(14)= 231.08 Prob>chi2=0.0000	chi2(14)= 150.24 Prob>chi2=0.0000	chi2(14)=164.45 Prob>chi2=0.0000
Sargan Test[a]	N/A	chi2(29)=31.23735 Prob>chi2=0.3543	chi2(29)=39.00324 Prob>chi2=0.1016	chi2(37)=57.48045 Prob>chi2=0.0170
AR(1)[b]	N/A	z=-2.7461 Prob > z= 0.0060	N/A	N/A
AR(2)[d]	N/A	z= 1.4298 Prob>z= 0.1528	N/A	N/A
Observations	590	387	387	546
No. of groups	130	112	112	130
No. of instruments	N/A	44	44	52

[a]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [b]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. *** show significance at 99 percent confidence interval; ** indicate significance at 95 percent confidence interval and * reflect significance at 90 percent confidence interval.

†We use Fixed-effects (within) regression clustered robust standard errors to estimate model 1, where R-sq: within = 0.2493, between = 0.0458 and overall = 0.1020

†† We estimate model 2 using two-step Arellano-Bond dynamic panel-data estimation with Windmeijer bias correction.

††† We estimate model 3 using one-step Arellano-Bond dynamic panel-data estimation robust standard errors

†††† We use one-step System dynamic panel-data estimation robust standard errors to estimate model 4.

Second, we also use overlapping rolling regressions in which we divide the total sample into two samples: Sub-sample 1 and Sub-sample 2. In Sub-sample 1, we use the first 458 observations (84 percent of the total observations) and in Sub-sample 2, the last 382 observations (70 percent of the total observations). The first sub-sample eliminates MFIs in southern Africa and the second sub-sample removes MFIs in eastern Africa. We are

unable to run the regression for each sub-region due to the dynamic nature of our model as it requires large number of observations given the large number of instruments in our models. The results are summarized in Table 14. In Table 14, while Model 1 replaces Model 2 in Table 11, Model 2 replaces Model 4 in Table 11. The results in Table 14 reveal that, more or less, our results are robust during contractions.

We find robust results that MFI specific factors viz. capitalization, liquidity and size have significant positive association with MFI credit growth while profitability has a significant negative effect on the loan growth of MFIs. The results also reveal that credit growth is negatively related to deterioration in the portfolio quality of MFIs, but not significantly, consistent with our main results in Table 11. The results also show robust evidences that scale dummies also affect credit growth significantly. As to the effect of macroeconomic factors, although we are unable to confirm the pro-cyclicality of credit growth of MFIs, we find a robust result that catch-up effect is significant.

Nevertheless, the results suggest, to some extent, that the effects of certain determinants on credit growth could vary based on the location of MFIs. For example, liquidity has a significant positive effect on credit growth in Sub-sample 2 while its effect on credit growth in Sub-sample 1 is less pronounced. Similarly, while inflation is a significant determinant of credit growth in Sub-sample 1, it has an insignificant effect on loan growth in Sub-sample 2. We also find that the global financial crisis (GFC2008) has a significant negative impact on credit growth of MFIs in Sub-sample 1 but not in Sub-sample 2.

Table 14*: Drivers of MFI Lending Behavior: Overlapping rolling Regression Results*

Variables	Sub-Sample 1		Sub-Sample 2	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Credit Growth (LB): Dependent Variable				
Credit Growth (Lag)	**0.1834****	**0.1767****	**0.2021*****	**0.2008*****
Capitalization $(CATR)_{t-1}$	**0.533***	**0.5091***	**0.5912****	**0.7166****
Profitability $(PROF)_{t-1}$	**-1.3109*****	**-1.487*****	**-1.155***	**-1.2945****
Portfolio Risk $(RISK)_{t-1}$	**-0.3124**	**-0.5207**	**-0.542**	**-0.5852**
Liquidity $(LIQ)_{t-1}$	**0.5756**	**0.7253***	**1.4593*****	**1.6252*****
Size $(LNTA)_t$	**0.4553*****	**0.4342*****	**0.3868*****	**0.5012*****
GDP Growth $(GDPG)_t$	**0.7162**	**0.7491**	**1.6727**	**1.3055**
Inflation $(INF)_t$	**0.5978****	**0.5033***	**-0.6545**	**-1.0496**
Employment $(EMP)_t$	**-1.1416**	**-2.5311***	**-1.7056**	**-0.838**
GDP per Capita $(CUP)_t$	**-0.6014****	**-0.7161*****	**-0.4317***	**-1.0489*****
Large Scale $(LSCA)_{t-1}$	**-0.4033*****	**-0.3593*****	**-0.3796*****	**-0.4111*****
Small Scale $(SSCA)_{t-1}$	**0.4197*****	**0.4119*****	**0.3189*****	**0.3158*****
Financial Crisis (GFC2008)	**-0.1673****	**-0.1447****	**-0.1465***	**-0.0544**
Financial Crisis (GFC2009)	**0.0358**	**0.0416**	**0.0126**	**-0.0068**
Bank[a]		**0.224**		**0.8996**
Rural Bank[a]		**3.0972**		**8.5476**
Credit Unions/Cooperatives[a]		**-1.3089**		**-2.4851**
NGOs[a]		**-0.1159**		**-2.0827**
Constant	**-2.7116**	**-0.3217**	**-2.4174**	**0.6692**
Wald Test	chi2(14)= 267.38 Prob>chi2=0.0000	chi2(18)= 395.54 Prob>chi2=0.0000	chi2(14)= 538.62 Prob>chi2=0.0000	chi2(18)= 319.26 Prob>chi2=0.0000
Sargan Test[c]	chi2(36)=28.66447 Prob>chi2=0.8027	chi2(32)= 25.86178 Prob>chi2=0.7697	chi2(37)=33.51797 Prob>chi2=0.6331	chi2(33)=30.52746 Prob>chi2= 0.5908
AR(1)[d]	z= -2.3014 Prob > z=0.0214	z= -2.2767 Prob > z= 0.0228	z= -2.6589 Prob > z=0.0078	z= -3.0522 Prob > z=0.0023
AR(2)[d]	z= 1.0975 Prob > z=0.2724	z= 1.1365 Prob>z= 0.2557	z= 1.0593 Prob> z= 0.2894	z= 0.88683 Prob > z=0.3752
Observations	458	458	382	382
No. of groups	108	108	95	95
No. of instruments	51	51	52	52

[a] These indicators represent legal status of MFIs where NBFIs are the benchmarks; [b] These are indicator variables reflecting the sub-region where the MFIs are operating where the benchmark sub-region is Eastern Africa; [c]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [d]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. *** show significance at 99 percent confidence interval; ** indicate significance at 95 percent confidence interval and * reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

Finally, since invariance/constancy of parameters is an important property of causal models and stability of the results increases the usefulness of our findings to policy making, we checked the robustness of the results across time periods using a time varying analysis. We divided the time horizon into three sub-periods: the years 2004–2007, i.e. the pre-crisis period, the second period (2008–2009) (i.e. the global financial crisis period) and the third period (2010–2014), post-crisis. Then, we construct dummy variables which take a value of 1 during the pre-crisis period (BGFC) and post-crisis period (AGFC), otherwise, zero. Finally, we created interaction terms of the predictor variables with the aforementioned indicator variables and re-estimated our benchmark model (Model 2 in Table 11) by incorporating the interaction terms.

The results show that the sign and statistical significance of the effects of MFI credit growth determinants before, during, and after the crisis are preserved; capitalization, profitability, liquidity, size, GDP growth and GDP per capita significantly influence the lending behavior of MFIs. This shows that our findings are consistent across time periods (Table 15 for the results). Nevertheless, a slight reduction in the statistical significance of the important covariates has occurred. This is due to the inclusion of several irrelevant interaction terms which inflates the standard errors. Column 2 confirms this explanation. When we drop irrelevant interaction terms and re-run our GMM regression, we could notice that the statistical significance of the determinants improves.

On the other hand, the coefficient for the interaction term between GDP per capita and pre-crisis dummy is positive and significant while the interaction effect of GDP per capita and post-crisis dummy is statistically insignificant. This means that catch-up phenomenon is stronger during and subsequent to the global financial crisis. In addition, credit growth is negatively related to inflation during and prior to the global financial crisis, though not statistically significant; whereas, its effect subsequent to the crisis period is positive and statistically significant.

The negative coefficient of inflation during the crisis period could be due to food and fuel price shocks in low income countries in this period (Ha, Kose & Ohnsorge, 2019), which affected the lives of the poor (i.e. the borrowers); this is also consistent with the literature which revealed that MFIs and their clients had been hurt by the food and financial crisis (CGAP, 2009). The result is in line with the finding of Wagner and Winkler (2012) who documented a negative association of inflation with credit growth during the global financial crisis.

Table 15: *Drivers of MFI Lending Behavior– Time Varying Analysis*

Variables	**Column 1**[†]	**Column 2**
Credit Growth (LB): Dependent Variable		
Credit Growth (Lag)	0.0202	0.1379**
Capitalization $(CATR)_{t-1}$	0.6021*	0.6776***
Profitability $(PROF)_{t-1}$	-1.1247*	-1.1716**
Portfolio Risk $(RISK)_{t-1}$	-0.1302	-0.2863
Liquidity $(LIQ)_{t-1}$	0.9556**	1.008***
Size $(LNTA)_t$	0.5666***	0.5426***
GDP Growth $(GDPG)_t$	2.1232**	1.3811*
Inflation $(INF)_t$	-0.2552	-0.3592
Employment $(EMP)_t$	-1.0491	0.1884
GDP per Capita $(CUP)_t$	-0.7954**	-0.6634***
Large Scale $(LSCA)_{t-1}$	-0.3318**	-0.4112***

Small Scale $(SSCA)_{t-1}$	0.3851***	0.4218***
Pre-crisis (BGFC)	-1.2224	-1.3358**
Post-crisis (AGFC)	-0.2836	0.1965
INF*BGFC	-0.3057	-0.0886
INF*AGFC	1.6281*	2.1618**
CUP*BGFC	0.3153***	0.2237**
CUP*AGFC	0.047	-0.0534
Other Interaction Terms	**YES**	**NO**
Constant	-3.4659	-4.7194**
Wald Test	chi2(34)= 483.08 Prob>chi2=0.0000	chi2(18)= 222.47 Prob>chi2=0.0000
Sargan Test[a]	chi2(36)= 49.14938 Prob>chi2=0.0708	chi2(36)= 33.0781 Prob>chi2= 0.6083
AR(1)[b]	z= -2.2802 Prob > z= 0.0226	z= -2.5332 Prob > z= 0.0113
AR(2)[b]	z= 0.78801 Prob > z= 0.4307	z= 1.2523 Prob>z= 0.2104
Observations	542	543
No. of groups	130	130
No. of instruments	71	55

[a]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [b]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. *** show significance at 99 percent confidence interval; ** indicate significance at 95 percent confidence interval and * reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

[†]In Column 1, we did not report test results for 'other interaction terms' since the results are statistically insignificant.

6.3 Capital Adjustment Process and Lending Behavior

The question of whether and how capitalization impacts lending behavior has been widely debated since the 1988 Basel capital accord (Bernanke & Lown, 1991; Berrospide & Edge, 2010; Carlson et al., 2013; Karmakar & Mok, 2013; Covas, 2016; Gambacorta & Shin, 2018). The prior studies applied different frameworks in modeling the channel going from capitalization to loan supply. While some prior empirical research used either the capital-to-asset ratio directly (Berrospide & Edge, 2010; Laidroo, 2012; Carlson et al., 2013; Cucinelli, 2016; Gambacorta & Shin, 2018), some other studies employed the

capital adequacy ratio/regulatory based capital surplus/shortfall (Gambacorta & Mistrulli, 2004; Karmakar & Mok, 2013; Carlson et al., 2013; Covas, 2016).

On the other hand, studies that build on the Berrospide and Edge (2010) and Thibaut and Mathias (2014) framework and examine whether capital impacts lending through the deviation (i.e. divergence between the actual level of capital and the desired level of capital) are missing[32]. More importantly, prior research was based on empirical data from the banking industry and studies on the effect of capitalization on MFI lending behavior are missing. Consequently, in this chapter, we discuss whether capitalization affects microfinance institution lending behavior through the deviation. Additionally, we test and provide evidence on the non-linear effect of capital on MFI credit growth and moderating role of capital on the relationship between credit growth and business cycle.

In this section, we begin by documenting the short-run and long-run determinants of MFI capitalization. Subsequently, we discuss whether capitalization affects the credit growth of MFIs through the divergence between the actual capital ratio and the implicit target capital. We also discuss whether capitalization has a non-linear effect on the credit growth of MFIs. Finally, we document whether the business cycle has asymmetric effect on MFI credit growth depending on the capitalization of MFIs. Section 6.2 and this section (Section 6.3) taken together provide evidence on which alternative measures of capitalization (equity-to-asset ratio or the *deviation*) yields better explanatory power in predicting lending behavior of MFIs.

[32] Berrospide and Edge (2010) and Thibaut and Mathias (2014) are the two worth mentioning studies in this connection.

6.3.1 The drivers of MFIs' capitalization

One of the main aims of this chapter was to estimate the parameters for the capitalization equation (*Eq.7*), predict the target capital, determine the deviation, and examine whether capitalization impacts the lending behavior of MFIs through the deviation. The GMM results on the short-run determinants of MFI capitalization are summarized in Table 16. The findings show that the capitalization of MFIs is moderately persistent. Taking the more accurate model (i.e. Model 2), the coefficient for the lagged capital ratio is 0.4376 implying that when there is a 1% shock to capital in the current period, there will be a 43.76% reduction in the capital ratio in the following period. In other words, the speed of adjustment to equilibrium is only 56.24% which shows the existence of capital adjustment difficulty in MFIs. This could support the relevance of capitalization in predicting the lending behavior of MFIs; if MFIs can adjust their capitalization instantaneously, then it will be the lending behavior that predicts capitalization since MFIs can adjust their capital to achieve the desired credit growth. The capital adjustment difficulties might be due to imperfections in the market for equities.

Table 16*: Drivers of MFI Capitalization (Short Run Relationships)*

Variables	Model 1	Model 2
Capitalization (CAP): Dependent Variable		
Capitalization $(CAP)_{t-1}$	0.3646**	0.4376***
Portfolio Risk $(RISK)_t$	-0.4998*	-0.486*
Profitability $(PROF)_t$	0.3546**	0.435***
Liquidity[1] $(LIQ)_t$	-0.0899***	-0.0856***
Deposit Growth $(DEPG)_t$	-0.00041	-0.0039
Large Scale $(LSCA)_t$	-0.0441*	-0.0537**
Small Scale $(SSCA)_t$	0.0563**	0.055**
GDP Growth $(GDPG)_t$	-0.1658	-0.2633
Bank[a]	-0.0335	
Rural Bank[a]	0.5045	
Credit Unions/Cooperatives[a]	0.0885	

NGOs[a]	-0.1265	
Constant	0.2826***	0.2796***
Wald Test	chi2(12)= 1139.20 Prob>chi2=0.0000	chi2(8)=2797.70 Prob>chi2=0.0000
Sargan Test[b]	chi2(44)=45.86189 Prob>chi2=0.3949	chi2(48)= 51.46273 Prob>chi2= 0.3398
AR(1)[c]	z= -.71759 Prob > z= 0.4730	z= -.90986 Prob > z= 0.3629
AR(2)[c]	z= -1.1383 Prob > z= 0.2550	z= -1.1235 Prob>z= 0.2612
Observations	534	534
No. of groups	127	127
No. of instruments	57	57

[1]We measure liquidity using the deposits to loans ratio. [a]These indicators represent legal status of MFIs where NBFIs are the benchmarks; [b]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [c]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. ***show significance at 99 percent confidence interval; **indicate significance at 95 percent confidence interval and *reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

The results also revealed that portfolio risk has a significant negative effect on capitalization at 10 percent level of significance. This implies that MFIs which are less risk averse expand credits by increasing leverage since it is difficult to obtain adequate equity capital to support the desired credit growth; this could lead to lower capital ratio in such MFIs. This is in line with the literature that documents financial institutions in cities with higher competition extend more credit and choose a higher leverage (Carlson et al., 2018).

We also found that profitability significantly contributes to the capitalization of MFIs. Since it is difficult to obtain external equity capital in MFIs and MFIs do not generally make dividend payments, profitable MFIs could rely on internal financing to external financing to meet their funding needs. Furthermore, the liquidity (as measured by the deposits to loans ratio) of MFIs is negatively and significantly associated with

capitalization. The result is statistically significant at 99 percent confidence interval. The finding confirms that MFIs with more asset liquidity hold lower capital since the required minimum risk based regulatory capital is lower in these institutions as liquid assets have lower risk weights.

Similarly, large scale MFIs have lower capitalization while small scale MFIs have higher capitalization implying that the capitalization of MFIs is negatively related to their size consistent with the "too big to fail" (TBTF) hypothesis. TBTF hypothesis implies that since large financial institutions are so important to the economy and that their failure could cause a drastic domino effect on the entire economy, there could be government intervention when they are in financial trouble and hence, large financial institutions may engage in moral hazard behavior due to those protective policies (Mattana, Petroni, & Rossi, 2015).

The sign of deposit growth is in line with theoretical expectations as MFIs mobilize more savings and rely more on deposits for funding the loans, total assets will increase which in turn reduces the capital ratio, other things ceteris paribus. However, the result is not statistically significant. This could be due to the fact that the deposit mobilization (as measured by deposit to asset ratio) of MFIs in SSA is more or less constant across time despite the rapid growth of MFI's deposits and this could be the rationale for the statistically insignificant result. The findings also revealed that business cycle has no significant effect on the capitalization of MFIs.

Although the One-Way ANOVA and the multiple linear regression results discussed in Chapter 5 (Section 5.2) showed that capitalization significantly differs across legal status, the GMM results here provided contrary evidence; we found that legal statuses have no significant effects on MFI capitalization. This implies that capitalization differences across legal status are due to the included economic fundamentals and not due to any other factors. Finally, we uncovered that the constant is statistically significant and has the highest economic significance. This is consistent with the literature which showed that capital ratio fluctuates mainly around a firm-specific time-invariant component (Flannery & Rangan, 2006; Lemmon et al., 2008; Gropp & Heider, 2010; Berrospide & Edge, 2010; Thibaut & Mathias, 2014).

6.3.2 Capital adjustment process and MFIs' credit growth

In order to examine the effect of capitalization on MFI lending behavior through the divergence between the actual capital ratio at time *t-1* and the long run target capital at time *t*, first we derived the long run coefficients from the short run coefficients in Table 16 using the approach described in Section 6.3. The standard errors are approximated by the *Delta* method. Next, we estimated the target capital using the long run coefficients. Then, we calculated the capital surplus/shortfall as the difference between the actual capital ratio at time *t-1* and the desired capital at time *t*. Finally, we tested whether the capital surplus/shortfall (i.e. the deviation) predicts the lending behavior of MFIs.

The findings revealed the same kinds of explanatory variables to be the long run determinants of capitalization as the short run determinants. We found that portfolio risk, profitability, liquidity, large scale indicator, and small scale indicator are the important

factors to explain capitalization in the long run (Table 17) consistent with the short run findings (Table 16). Table 17 also shows that the constant is statistically significant. Now the coefficients are much greater than their respective short run coefficients due to the existence of persistency in MFI capitalization.

Table 17: *Drivers of MFI Capitalization (Long Run Relationships)*

Variables	Coefficients
Capitalization (CAP): Dependent Variable	
Portfolio Risk $(RISK)_t$	-0.8642008***
Profitability $(PROF)_t$	0.7735777***
Liquidity[a] $(LIQ)_t$	-0.152159***
Deposit Growth $(DEPG)_t$	-0.0069146
Large Scale $(LSCA)_t$	-0.095485**
Small Scale $(SSCA)_t$	0.0977306**
GDP Growth $(GDPG)_t$	-0.4682367
Constant	0.4971148***

[a] We measure liquidity using the deposits to loans ratio. *** show significance at 99 percent confidence interval; ** indicate significance at 95 percent confidence interval and * reflect significance at 90 percent confidence interval.

Once we derived the long run coefficients and determined the target and the deviation, we estimated the effect of the deviation by using the following lending behavior model developed in Chapter 4:

$$\begin{aligned} LB_{i,c,t} = {} & \alpha_0 + \beta_1 LB_{i,c,t-1} + \psi(DEV_{i,c,t}) + \phi_1 LIQ_{i,c,t-1} + \phi_2 RISK_{i,c,t-1} + \phi_3 PROF_{i,c,t-1} \\ & + \phi_4 LNTA_{i,c,t} + \phi_5 LSCA_{i,c,t-1} + \phi_6 SSCA_{i,c,t-1} + \pi_1 GDPG_{i,c,t} + \pi_2 INF_{i,c,t} + \\ & \pi_3 EMP_{i,c,t} + \pi_4 CUP_{i,c,t} + \gamma_1 GFC2008_t + \gamma_2 GFC2009_t + (\eta_i + \varepsilon_{i,c,t}) \end{aligned}$$

The results (Model 1 & 2 in Table 18) fail to support the prior empirical evidences (Berrospide & Edge, 2010; Thibaut & Mathias, 2014) that show capitalization could impact the lending behavior of financial institutions through the deviation (i.e. the divergence between the actual capital ratio and the long run target capital). In this regard, Berrospide and Edge (2010) have revealed that there is a positive and significant

relationship between bank loan growth and excess capital, though the economic significance is small. They showed that, in the long-run, if capital exceeds (falls short of) its target level by 1 percent, there could be roughly a 0.25 percentage point increase (reduction) of annualized loan growth.

Similarly, Thibaut and Mathias (2014) also found an economically and statistically significant association of aggregate capitalization index at year $t-1$ with the change in aggregate lending at year t relative to year $t-1$. They reported that a decrease in the aggregate capitalization index by 1 percentage point results in a decrease of the growth rate of aggregate lending by 0.918 [0.267–1.568] percentage points, which was roughly 15% of the average change in aggregate lending. However, our findings show that, in the microfinance industry, capitalization does not impact lending behavior through the divergence between the actual capital ratio at time *t-1* and the target capital at time *t*.

In Section 6.2, we documented that capitalization (as measured by the book capital ratio) positively and significantly influences the credit growth of MFIs in SSA. The findings in Section 6.2 and 6.3 taken together suggest that either our model did not capture the target capital precisely or the target capital is not as such binding. That is, in order to achieve the desired credit growth, MFIs may violate strict adherence to their target capital. The book capital ratio have superior predictive power over the deviation possibly because the book capital ratio is easily observable and hence, regulatory authorities might increase their monitoring of MFIs with relatively low capital asset ratio (presumably). Hence, MFIs may not prefer holding relatively low capital ratio and may adjust their capitalization upwards to the industry median capital ratio by limiting lending; this view

is in line with the herding behavior theory. In this respect, using industry median capital structure, Camara (2017) revealed statistically significant evidence of herding in Services industry in the bear market.

Similarly, Ross, Westerfield, and Jaffe (2003) state that while scholars are always fascinated with far-reaching theories, in reality, almost any business firm has a debt-to-equity ratio to which companies in that industry adhere suggesting herding behavior in capital adjustment decisions. Moreover, financial institutions could avoid holding relatively low capital ratio in order to circumvent increased supervision from regulatory authorities. Accordingly, MFIs with lower capital ratio limit their loan supply to increase their capital to the industry median capital ratio while MFIs with higher capital ratio expand credits since they have adequate capitalization to absorb any anticipated and actual loan losses.

Table 18: *GMM Results: Capitalization and Credit Growth*

Variables	**Coefficients**		
	Model 1	**Model 2**	**Model 3**
Credit Growth: Dependent Variable			
Deviation (DEV)	0.114	0.1273	N/A
Capital ratio$_{i,c,t-1}$	N/A	N/A	1.087**
CAPD (over-capitalized dummy)	N/A	-0.1174	N/A
DEV*CAPD	N/A	0.2867	N/A
Lower quartile (Lag)[a]	N/A	N/A	0.1861
Upper quartile (Lag) [a]	N/A	N/A	0.3782
Capital ratio*Lower quartile	N/A	N/A	-0.6525
Capital ratio*Upper quartile	N/A	N/A	-0.6226
Other Control Variables	YES	YES	YES
Scale Dummies	YES	YES	YES
Crisis Time Fixed Effects	YES	YES	YES
Constant	YES	YES	YES
Wald Test	chi2(14)= 94.98	chi2(16)= 83.97	chi2(18)= 138.95

	Prob>chi2=0.0000	Prob>chi2=0.0000	Prob>chi2=0.0000
Sargan Test[b]	chi2(36)=39.89914 Prob>chi2=0.3009	chi2(36)=40.31641 Prob>chi2=0.2852	chi2(36)=35.68681 Prob>chi2=0.4834
AR(1)[c]	z= -1.8053 Prob > z= 0.0710	z= -1.5574 Prob > z= 0.1194	z= -2.4649 Prob > z= 0.0137
AR(2)[c]	z=1.0201 Prob > z= 0.3077	z=1.0113 Prob > z= 0.3119	z=1.4655 Prob > z= 0.1428
Observations	421	421	541
No. of groups	117	117	129
No. of instruments	51	53	55

[a]Indicator variables which take 1 for the lower quartile capital ratio or the upper quartile capital ratio, otherwise zero. The 25th percentile capital ratio was 15.49% while the 75th percentile capital ratio was 45.545%. [b]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [c]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. ***show significance at 99 percent confidence interval; **indicate significance at 95 percent confidence interval and *reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

Finally, although the literature from the banking industry shows that the response of credit growth to capitalization is nonlinear (Carlson et al., 2013; Thibaut & Mathias, 2014), we fail to find evidence supporting a non-linear effect of capitalization on MFI credit growth (Model 2 & 3 in Table 18). Thibaut & Mathias (2014) argue that the effect of capitalization on loan growth for over-capitalized banks could be less marked since "banks cannot force agents to borrow while they can prevent them from getting funds: the extent of the increase in lending is possibly more sensitive to changes in the demand than the supply of credit" (P.16).

In respect of the above, Thibaut and Mathias (2014) found that in countries/periods where banks are under-capitalized, the growth rate of aggregate lending tends to decrease significantly while such patterns do not exist during episodes of aggregate over-capitalizations. Similarly, Carlson et al. (2013) found that the elasticity of bank lending with respect to capital ratios is higher when capital ratios are relatively low. Nevertheless, in the microfinance industry, we do not find asymetric effect of capitalization on credit

growth across over-capitalized and under-capitalized MFIs (Model 2) or across upper quartile and lower quartile capital ratio (Model 3) and hence, our results suggest that there is high demand for microfinance credits in SSA and supply factors like capitalization matter in expanding credit access to the poor regardless of how high the capitalization of MFIs is.

6.3.3 Business cycle and MFI credit growth: Any evidence of asymmetric effect based on MFI capitalization?

Although our findings in Section 6.2 establish that MFI lending behavior is pro-cyclical possibly due to pro-cyclicality of demand for loans, financial institution loan supply could respond differently to the business cycle depending on the level of capitalization (Gambacorta & Mistrulli, 2003, 2004).

Two reasons could explain the asymmetric effect of economic activity on lending behavior: Firstly, financial institutions deeply involved in relationship lending are likely to smooth lending over the business cycle (Beck, Degryse, De Haas, & Van Horen, 2014) and in this regard, well-capitalized financial institutions could absorb temporary financial difficulties on the part of their borrowers better. Secondly, the level of capitalization could be associated with the degree of risk aversion; this is in line with the literature which emphasized a link between risk aversion and capitalization (Rochet, 1992; Michelangeli & Sette, 2016). Financial institutions with lower risk aversion select ex ante a loan portfolio with higher return and risk and consequently, their borrowers are likely to be more financially fragile and thus more exposed to economic downturns.

These concerns raise an important empirical question: Does MFI lending respond differently to economic shocks depending on the level of capitalization?

In regard to the above research question, our findings fail to find evidence to support any asymmetric effect of the business cycle on the credit growth of MFIs based on whether the MFIs are over-capitalized or under-capitalized (Model 1 in Table 19) or across upper quartile and lower quartile capital ratio (Model 2 in Table 19). In this connection, the literature revealed that the loan supply of well-capitalized banks is less pro-cyclical implying that well-capitalized financial institutions are more risk-averse and face lower defaults during economic downturns since they have less risky borrowers (Gambacorta and Mistrulli, 2003).

Gambacorta and Mistrulli (2003) also state that well-capitalized banks could preserve long term lending relationships with borrowers as they can better absorb temporary financial difficulties on the part of their borrowers. However, our findings show that the lending behavior of under-capitalized MFIs is not more pro-cyclical and that the lending behaviors of MFIs with different levels of capitalization have the same reaction to GDP shocks indicating that the lending behavior of under-capitalized MFIs is more resilient than the lending behavior of under-capitalized banks.

Table 19*: Business Cycle and Credit Growth– the Moderating Role of Capitalization*

Variables	**Coefficients**	
	Model 1	**Model 2**
Credit Growth: Dependent Variable		
Capital ratio (Lag)	1.1094***	0.5004
CAPD (over-capitalized dummy)	-0.2213	N/A
Lower quartile (Lag)[a]	N/A	0.0997
Upper quartile (Lag)[a]	N/A	0.176

GDP Growth	0.6942	2.0951*
GDP Growth*CAPD	1.3481	N/A
GDP Growth*Lower quartile	N/A	-1.167
GDP Growth*Upper quartile	N/A	-0.5384
Other Control Variables	YES	YES
Scale Dummies	YES	YES
Crisis Time Fixed Effects	YES	YES
Constant	YES	YES
Wald Test	chi2(16)= 131.40 Prob>chi2=0.0000	chi2(18)=128.17 Prob>chi2=0.0000
Sargan Test[b]	chi2(36)=33.63424 Prob>chi2=0.5816	chi2(36)= 33.76406 Prob>chi2=0.5754
AR(1)[c]	z= -1.9959 Prob > z= 0.0459	z= -2.5074 Prob > z= 0.0122
AR(2)[c]	z= 0.79102 Prob > z= 0.4289	z= 1.492 Prob > z= 0.1357
Observations	414	541
No. of groups	116	129
No. of instruments	53	55

[a]Indicator variables which take 1 for the lower quartile capital ratio or the upper quartile capital ratio, otherwise zero. The 25th percentile capital ratio was 15.49% while the 75th percentile capital ratio was 45.545%. [b]Sargan test of over-identifying restrictions where H0: over-identifying restrictions are valid. [c]Arellano-Bond test for zero autocorrelation in first-differenced errors where H0: no autocorrelation. ***show significance at 99 percent confidence interval; **indicate significance at 95 percent confidence interval and *reflect significance at 90 percent confidence interval. We use two-step system GMM with Windmeijer bias correction to estimate the models.

6.4 Summary of Main Findings

In this study, we examine the determinants of MFI lending behavior based on unbalanced panel dataset of 130 MFIs operating across 31 countries during the period 2004–2014 constituting 546 usable observations as a basis for the econometric analysis. Accordingly, using the Arellano-Bover/Blundell-Bond two-step Generalized Method of Moments (GMM) Windmeijer bias-corrected standard errors, we show that both MFI specific and macroeconomic factors matter in the lending behavior of MFIs. We found new and interesting finding that more profitable MFIs are more risk averse and cautious in extending credit. The results also reveal that MFIs with greater retention of earnings

and therefore higher capital would be better able to ease credit conditions for the poor, which is consistent with the capital crunch hypothesis.

In addition, we find that liquidity has a positive association with credit growth and more importantly, when we compare the effect of liquidity with the effect of capitalization, the results show that the effect of liquidity has higher relative economic importance. As to the effect of size, the findings show that if MFIs are able to increase their size, say, by attracting more deposits, raising/obtaining equity capital and non-deposit borrowings, among others, they can increase credit access to the poor. However, other MFI specific factors namely portfolio quality, deposit growth and non-deposit borrowing growth have little direct effects on MFI credit growth.

The results also show that in addition to MFI specific factors, macroeconomic factors matter in the lending behavior of MFIs. We uncover that MFI credit growth is pro-cyclical. Furthermore, we find that GDP per capita has a significant negative effect on MFI credit growth consistent with the theory of convergence. On the other hand, inflation and employment are not important covariates in the lending behavior of MFIs. We also show that profit status, regulation status, legal status, and location do not matter in the credit growth of MFIs, other things constant. Additionally, we document that there is marginal persistency in MFI credit growth in SSA. Using different specifications and estimation methodologies, overlapping rolling regressions, and time varying analysis, we are able to ascertain that our empirical findings are robust.

Nevertheless, the time varying analysis revealed that the catch-up phenomenon is stronger during and subsequent to the global financial crisis. Similarly, we found that credit growth is negatively related to inflation during and prior to the global financial crisis, though not statistically significant; whereas, its effect subsequent to the crisis period is positive and statistically significant.

Additionally, we confirm that there is capital adjustment difficulty in the microfinance industry in SSA. The findings, however, fail to support the hypothesis that capitalization impacts MFI lending behavior through the deviation. In light of our findings which revealed that capital impacts the credit growth of MFIs positively and directly through the book capital ratio, our findings suggest that MFI managers consider the current actual capital ratio (and not the deviation) in determining the extent of credit growth in subsequent year. The findings also show that business cycle and capitalization have no asymmetric effects on the credit growth of MFIs across over-capitalized and under-capitalized MFIs or across MFIs with upper quartile capital ratio and lower quartile capital ratio.

CHAPTER 7: CONCLUSIONS, IMPLICATIONS AND FUTURE DIRECTIONS

7.1 Introduction

Poverty alleviation is the first core goal of SDGs. Despite the crucial role of loan portfolio in the financial sustainability of MFIs, poverty eradication, and macro-economic stability, there is surprisingly little evidence of the drivers of the lending behavior of microfinance institutions. Accordingly, this study attempted to identify the determinants of MFI lending behavior utilizing a sample of 130 MFIs operating across 31 countries in Sub-Saharan Africa during the period 2004–2014. We believe that our findings contribute to practice and the literature by providing several new evidences on what drives MFI lending behavior.

This chapter winds up our study as follows. In Section 2, we provide a summary of the main findings and our conclusions. In Section 3, we discuss policy implications. Then, Section 4 indicates theoretical implications of our study and finally, Section 5 concludes the study by identifying research areas for further research.

7.2 Main Findings and Conclusions

The primary objective of this dissertation was to identify the factors that determine the lending behavior of MFIs with particular focus on whether and how capitalization impacts MFI credit growth. In this respect, based on a sample of 130 MFIs operating across 31 countries in Sub-Saharan Africa during the period 2004–2014 and using the Arellano-Bover/Blundell-Bond two-step Generalized Method of Moments (GMM)

Windmeijer bias-corrected standard errors, we show that both MFI specific and macroeconomic factors matter in the lending behavior of MFIs.

The effects of MFI-specific and macro-economic factors on credit growth are in line with theoretical expectations, with the exception of portfolio quality, deposit growth, non-deposit borrowing growth, inflation, and employment which are statistically insignificant to explain MFI lending behavior. Using different specifications and estimation methodologies, overlapping rolling regressions, and time varying analysis, we are able to ascertain that our empirical findings are robust. Although most of these findings are common in the banking literature, they are, nonetheless, new in the microfinance industry and establish that, more or less, the lending behavior of MFIs shares the characteristics of traditional bank lending. Nevertheless, the study has also uncovered some new findings that add to the literature on the drivers of the lending behavior of financial institutions.

More specifically, the study uncovered new and interesting finding that, unlike banks, MFIs that are more profitable are more risk averse and cautious in extending credit. While the banking industry is a profit motivated financial industry and requires collateral for the loans, the microfinance industry has to achieve the twin missions of financial sustainability and poverty reduction and may not hold tangible collaterals for the loans. Accordingly, since credit risk is a critical obstacle to profitability of MFIs in comparison to banks, more profitable MFIs could limit credits to limit portfolio risk and maintain their profitability. Conversely, MFIs that are less profitable have higher credit growth either because these MFIs take more risks and expand credits as a last resort to make profits and ensure the sustainability of the institution (Igan & Pinheiro, 2011) or because

these institutions focus more on their social missions rather than financial sustainability and therefore, focus more on credit expansions and by extension, outreach.

The profitability of MFIs could, however, contribute to the credit growth of MFIs positively by increasing MFI capital since it is one of the factors that determine the capitalization of MFIs. In this respect, consistent with the literature from the banking industry (Gambacorta & Mistrulli, 2004; Berrospide & Edge, 2010; Covas, 2016; Gambacorta & Shin, 2018), our findings show that capitalization has a significant positive impact on the credit growth of MFIs. The results suggest that MFIs with greater retention of earnings and therefore higher capital ratio would be better able to ease credit conditions for the poor, which is in line with the capital crunch hypothesis. The study, however, fails to support the hypothesis that capitalization impacts MFI lending behavior through the deviation (i.e. the divergence between the actual capital ratio and the implicit target). This may be due to model specification problem of the capital equation or that MFI managers consider the current actual capital ratio (and not the deviation from their own target) in determining the extent of credit growth in subsequent year.

The findings also revealed that liquidity has a positive association with credit growth and more importantly, when we compare the effect of liquidity with the effect of capitalization, the results show that the effect of liquidity has higher relative economic importance. As to the effect of size, the findings show that if MFIs are able to increase their size, say, by attracting more deposits, raising/obtaining equity capital and non-deposit borrowings, among others, they can increase credit access to the poor. However,

other MFI specific factors namely portfolio quality, deposit growth and non-deposit borrowing growth have little direct effects on MFI credit growth.

The results also revealed that in addition to MFI specific factors, macroeconomic factors also matter in the lending behavior of MFIs. We uncover that MFI credit growth is pro-cyclical. Furthermore, we find that GDP per capita has a significant negative effect on MFI credit growth consistent with the theory of convergence. In this respect, the findings revealed that catch-up phenomenon is stronger during and subsequent to the global financial crisis. In addition, credit growth is negatively related to inflation during and prior to the global financial crisis, though not statistically significant; whereas, its effect subsequent to the crisis period is positive and statistically significant. Nevertheless, employment is not an important covariate in the lending behavior of MFIs. We also show that profit status, regulation status, legal status, and location do not matter in the credit growth of MFIs, other things constant.

Additionally, we found that there is persistency in microfinance credit growth implying that there is less intense competition in the credit market of MFIs in Sub-Saharan Africa. This persistency in credit growth may be due to the persistency of market power and/or the persistency of productivity in the credit market of the microfinance industry in Africa. However, the departure from perfect competition is only marginal as the speed of adjustment is very high (i.e between 83.71 and 85.37 percent).

To sum up, the high capitalization of MFIs, fast growth of MFI funding (reflected in growth in total assets) and MFIs' orientation towards poverty reduction rather than financial sustainability seem to have contributed for the rapid credit growth of MFIs in

Sub-Saharan Africa. In the light of the low level of liquidity of probably most MFIs, the strong positive association of liquidity with loan growth shows that liquidity also plays a vital role in the lending behavior of MFIs. Furthermore, macroeconomic factors including GDP growth and GDP per capita also influence the credit growth of MFIs.

7.3 Policy Implications

The empirical evidences establish that both MFI-specific and macroeconomic variables are important factors in the lending behavior of MFIs. Our findings do provide several useful insights for MFI managers and policymakers such as central banks/regulatory authorities as well as the Basel Committee in various ways. First, the strong positive association of capitalization with MFI credit growth obviously confirms that certain MFIs in SSA are capital constrained. Although MFIs in SSA had been generally highly capitalized during the period under investigation, in the future, as MFIs get more livered and grow larger, the microfinance industry in SSA could face significant capital constraint to sustain its rapid credit growth. Moreover, since the microfinance industry in SSA is unprofitable, capital adjustment may be more difficult and capital constraint could be a serious impediment to the credit growth of MFIs.

Given our findings that MFI capitalization is positively associated with credit growth and MFI credit growth is pro-cyclical, the findings imply that at some point in the future central banks/regulatory authorities need to introduce a counter-cyclical capital buffer requirement in the microfinance industry since capital adjustment is difficult in MFIs in SSA. In particular, in the future when the microfinance industry gets more levered and grows larger and hence, faces significant capital constraints, the findings imply that

central banks/regulatory authorities should impose a counter-cyclical capital buffer requirement to help MFIs improve their solvency and be better able to absorb losses and still continue their normal business operations as well as meet capital requirements.

The introduction of counter-cyclical capital buffer requirement could also allow MFIs to grant more loans during an economic downturn, and thereby increase aggregate demand and contribute to economic recovery. Moreover, since one of the dual goals of MFIs is to achieve poverty reduction (i.e. social impact) by providing credit access to the poor, the microfinance industry could face excess credit growth during upturns compared to bank credit growth and hence, the counter-cyclical capital buffer requirement could protect the microfinance sector from periods of excess credit growth that may lead to systemic risk.

Second, the negative relationship between credit growth and profitability implies that MFIs that are less profitable have higher credit growth. To the extent that less profitable MFIs follow prudent risk management and appropriate loan pricing strategies, their lending behavior will not be detrimental to the achievement of their goals since they will be able to improve their profitability and, at the same time, expand their outreach to the poor. However, in the absence of the aforementioned strategies, such MFIs may suffer more from loan defaults which may severely affect their financial sustainability and their ultimate goal of achieving poverty eradication since financially unsustainable MFIs will fail to survive in the future. Hence, prudent risk management and appropriate loan pricing strategies are essential for MFIs to benefit from the rapid credit growth and attain the twin missions of MFI financial sustainability and sustainable poverty alleviation since MFIs in SSA are generally unprofitable and credit risk is one of the major obstacles to

MFI profitability. Given the role of financial sustainability of MFIs for sustainable poverty alleviation and the significance of profitability in building capital buffers, MFIs need also to devise and follow strategies that could improve their profitability.

Third, in light of previous findings (Muriu, 2011; Tehulu, 2013) which revealed credit risk negatively impacts the profitability of MFIs and our findings that portfolio risk depletes MFI capitalization, we suggest that proper risk management strategies and practices are vital not only in the financial sustainability of MFIs but also in expanding access to credits for the poor. If MFIs do not follow an appropriate risk management policies, MFIs with poor portfolio quality will fail to achieve their goals of financial sustainability and social impact in the long term especially given that the microfinance industry in SSA is unprofitable.

Fourth, considering the strong positive association of liquidity with credit growth of MFIs and the average liquidity of MFIs of about 21 percent over the period considered as well as the variability in liquidity among MFIs which is 15 percent, we can say that certain MFIs could face liquidity problem to meet withdrawal and loan demands. Specifically, given our findings that MFIs operating in western Africa and MFIs organized as NGOs and NBFIs were least liquid, liquidity problem could be a critical concern for such MFIs to maintain their rapid credit growth, especially, in the light of the high reserve/liquidity requirement in some MFIs (eg. MFIs in Ghana and Ethiopia) and the fact that any institutional depositors could withdraw substantial amount of funds at any given time (MIX & CGAP, 2010). Hence, MFIs need not only to increase their deposit mobilization but also to expand their depositor/funding base since it may be

difficult to secure adequate deposits/funds especially during periods of weak economic conditions. The findings also suggest that if MFIs are able to attract more deposits and non-deposit borrowings, they could improve their size in addition to their liquidity, and thereby expand credit access to the poor.

Fifth, the existence of slight persistency in credit growth and hence, less intense competition in the microfinance industry in SSA could constrain credit provision but has the advantage of supporting financial stability. Given that the level of competition sought requires a trade-off between credit expansion and financial stability, government policies shall prioritize the need for credit expansion versus MFI stability and determine the need for fostering competition versus introducing new barriers to competition (for example, through capital requirements) accordingly.

To sum up, strengthening micro and macro-prudential regulation aimed at improving financial soundness (such as portfolio quality, capitalization, profitability, and liquidity) and macroeconomic conditions (to induce economic growth as well as control unhealthy inflation) are needed to sustain the rapid credit growth of MFIs in SSA, and thereby enhancing MFI financial sustainability and eradicating poverty by expanding credit access to the poor, the dual bottomline of MFIs. MFIs could also attract more deposits and non-deposit borrowings to support their growth and improve liquidity, and thereby be better able to expand credit access to the poor.

7.4 Theoretical Implications

This study is the first study of its kind to examine the drivers of lending behavior in the microfinance industry in SSA. The study could, therefore, contribute to the literature in at least five ways. First, previous studies focused on bank lending behavior (Bernanke & Lown, 1991; Hancock & Wilcox, 1993, 1994; Gambacorta & Mistrulli, 2003; Berrospide & Edge, 2010; Thibaut & Mathias, 2014; and Gambacorta & Shin, 2018). To our knowledge, this study is the first comprehensive study to examine the determinants of credit growth of MFIs by incorporating MFI specific, macroeconomic and time invariant components exhaustively.

Second, our study focuses on MFI lending behavior in SSA where the gross loan portfolio (GLP) of MFIs is the lowest compared to the GLP of MFIs in other regions, and thereby providing empirical evidence on MFI lending behavior from developing economies. Third, we use a dynamic model so as to obtain consistent and unbiased estimates of the drivers of MFI lending behavior. The fixed effects estimation technique could be biased given a short panel such as ours and cannot estimate the effects of time invariant components as it drops them from the regression equation.

Fourth, our measure of the level of capitalization (capital surplus/shortfall) of a microfinance sector is very simple and easily replicable since it is based on balance sheet statement and macroeconomic data. This approach also allows considering a much larger number of microfinance institutions which otherwise would not be possible if our measure were based on risk weighted capital since data on capital requirement and risk weighted based capital are not available.

Fifth, this paper will inspire researchers to replicate the study in the microfinance industry in different regions or countries since this study is the first comprehensive study that examines the determinants of the credit growth of MFIs. Most importantly, this study provides new empirical evidence on whether and how capitalization predicts lending behavior in the microfinance industry. It also provides new evidence on whether MFIs' lending is resilient to GDP shocks as well as on whether the response of MFIs' lending to GDP shocks depends on the level of capitalization.

The study also provides new insights as to the relationship between credit growth and profitability of financial institutions. Unlike the banking industry where profitability contributes to the credit growth of commercial banks positively, we found that profitability has a negative effect on the credit growth of MFIs. This adds to the literature and arguments on the profitability–lending nexus in financial institutions in the context of MFIs. Moreover, given the mixed prior empirical evidence on the link between credit growth and size of financial institutions, our findings suggest that future research shall control for scale effects since this is likely to be the reason for a negative association of size with credit growth in prior studies.

Finally, the study contributes to the literature by showing that MFI capitalization, liquidity, and size are positively associated with credit growth and MFI credit growth is pro-cyclical but negatively related to GDP per capita consistent with the literature in the banking industry. The findings also establish the need to introduce a counter-cyclical capital buffer requirement in the microfinance industry like the one introduced in the

banking industry. All these findings add to the literature by showing that the lending behavior of MFIs largely shares the characteristics of bank lending.

7.5 Recommendations for Further Research

The crucial role of loan portfolio in the financial sustainability of MFIs, poverty eradication, and macro-economic stability establishes the need for a more in-depth understanding of the lending behavior of MFIs. Accordingly, we wind up our study by suggesting research areas for further study.

Although this study has identified what explains the credit growth of MFIs in SSA, whether the drivers of credit growth vary depending on the loan types is an empirical question. In this connection, using credit-registry data for Spain and Peru, Ivashina, Laeven, and Moral-Benito (2020) showed that the determinants of credit growth vary across loan types. The finding of Bernanke and Lown (1991) also give some clue that the relationship between loan growth and its potential determinants could depend on the loan types. Therefore, future studies could investigate whether the determinants of credit growth are consistent across sub-categories of loans. We are unable to test whether this assertion holds true in the microfinance industry due to lack of data on gross loan portfolio by loan types in our data set.

In light of our findings which revealed that the credit growth of MFIs in SSA is rapid, the other main question for future research is: Is the rapid credit growth of MFIs in SSA an equilibrium convergence process or an abnormal growth that may rather pose systemic risks? Hence, future studies could make a comparative analysis of the credit growth of

MFIs among the four regions of SSA and determine which region's credit growth was an equilibrium convergence process or abnormal growth.

It is also vital to recognize the fact that efficiency is an important concern in dynamic models in that the larger the number of observations, especially the number of MFIs, the more reliable the results. In this regard, we reported in Chapter 6 that while the effect of portfolio risk on credit growth is generally insignificant in dynamic models, its effect is statistically significant under the Fixed Effects estimator, which may be due to the larger number of observations in the Fixed effects estimation while the dynamic models exhibit lower number of observations due to missing values since these models employ differencing. Therefore, future studies could carry out a similar analysis for all developing economies or the entire global data set in order to improve model efficiency. Due to differences in culture, value and institutional environment, among other things, it is also an unwarranted conclusion to claim what works for MFIs in SSA also holds true for other developing economies or regions. Accordingly, future research could also test the replicability of our findings in other developing economies or regions.

Empirical evidences on the moderating effects of regulation, profit and/or legal status on the capitalization–credit growth nexus of MFIs are also missing. Consequently, future studies could examine whether capitalization has asymmetric effect on MFI credit growth based on whether the microfinance institution is regulated or unregulated, has a for-profit or not-for-profit status as well as the charter type of the microfinance institution. This could help to produce stylized facts for future theory development. Since every research has its own delimitations, we preferred to leave such tests for future study.

Given that the rapid credit growth of MFIs will bring about sustainable poverty alleviation only if credit expansions contribute to the financial sustainability of MFIs, we recommend future studies shall also examine the effect of credit growth on the financial sustainability of the microfinance industry in Sub-Saharan Africa. The prior empirical evidences employed the loan-to-assets ratio to capture loan supply in examining the determinants of MFI profitability/financial sustainability. However, the loan to assets ratio is not an appropriate measure of loan supply as the loan portfolio is scaled by total assets and hence, changes in total assets also determine the variable's value.

In simpler terms, loan-to-assets ratio helps to measure just loan intensity and do not allow to accurately capturing changes in loan supply. Hence, empirical research is needed to test whether the rapid credit growth is contributing to the financial sustainability of MFIs in Sub-Saharan Africa. Finally, future research could additionally study the consequences of rapid credit growth on microfinance institution soundness (i.e. portfolio risk) in order to gain a deeper understanding of MFI lending behavior and for better policy making.

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Appendix

Table A: *Description of Variables and Their Measurements*

No.	Variables	Description	Measure	Expected Sign
1.	Lending Behavior (LB): Dependent Variable	Growth rate of Gross Loan Portfolio (GLP) where GLP is all outstanding principals including current, delinquent, and renegotiated loans, but not loans that have been written off.	(GLP_t/GLP_{t-1})-1	NA
2.	Capital ratio (CTAR)	Total equity compared to assets	Total Equity/ Total Assets	+/-
3.	Capital Surplus/shortfall (DEV)	It represents the deviation between the actual level of capital at time *t-1* and the target capital at time *t*	Capital ratio at *t-1* less the predicted capital ratio for time *t*	+/-
4.	Risk: Portfolio at risk > 30 days (%) (RISK)	Represents the portion of loans greater than 30 days past due, including the value of all renegotiated loans compared to gross loan portfolio.	(Outstanding balance, portfolio overdue > 30 days + Renegotiated loans)/ Gross loan portfolio	-
5.	Profitability (PROF)	The proxy is Return on Assets (ROA): Net operating income (less of taxes) compared to average assets.	(Net operating income, less Taxes)/ Average assets	+/-
6.	Liquidity: Non-earning liquid assets as a % of total assets (LIQ)	Total cash and cash equivalents compared to total assets including short-term investments	Cash and cash equivalents /Total assets	+
7.	Size (LNTA)	The size of the microfinance institution measured in terms of the natural logarithm of total assets	LN(Total Assets)	+/-
8.	Deposit Growth (DEPG)	The total value of funds placed in an account with a MFI that are payable to a depositor.	Growth rate of deposits	+
9.	Funding Growth (FUNG)	It captures capital inflows into the microfinance sector	Growth of total non-deposit funding liabilities. Total non-deposit funding	+

		from domestic and international financial markets.	liabilities are defined as the difference between total assets and the sum of equity and deposits.	
10.	Scale (large–LSCA and small–SSCA)	This measures the size of the gross loan portfolio in USD	Takes one for large (LSCA) or small (SSCA), otherwise zero; Large: > 8 million; Medium: 2 million – 8 million; Small: < 2 million	- ,+ Resp.
11.	GDP growth (annual %) (GDPG)	Annual percentage growth rate of GDP at market prices based on constant local currency		+
12.	Inflation, consumer prices (annual %) (INF)	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services		+
13.	Employment Rate (EMP)	Employment ratio is the proportion of a country's population that is employed. Ages 15 and older are generally considered the working-age population.	Employment to population ratio, 15+, total (%)	+
14.	Catch-up Phenomenon (CUP)	It indicates the level of institutional and economic development of a country	GDP per capita (current US$)	-
15.	Global financial crisis (GFC2008 and GFC2009)	It is represented by indicator variables to allow us test which year of the GFC years has a higher impact	GFC2008 takes one for year 2008 otherwise zero; GFC2009 takes one for year 2009 otherwise zero	-

Table B: *Pair-wise Correlation Matrix of Predictor Variables*

	L.capi~o	L.retu~s	L.p~30~s	L.none~l	sizelnta	deposi~e	nondep~e
L.capitala~o	1.0000						
L.returnon~s	0.0041 0.9038	1.0000					
L.por~30days	-0.1315* 0.0002	-0.1867* 0.0000	1.0000				
L.nonearni~l	-0.0674 0.0643	-0.1304* 0.0004	0.1062* 0.0073	1.0000			
sizelnta	-0.1900* 0.0000	0.2572* 0.0000	-0.0235 0.5196	0.0391 0.2939	1.0000		
depositsgr~e	0.1432* 0.0001	-0.0623 0.1089	-0.1364* 0.0008	0.0282 0.4651	-0.0989* 0.0094	1.0000	
nondeposit~e	0.0199 0.5415	0.0245 0.4723	-0.0148 0.6816	0.0275 0.4568	-0.0175 0.5940	-0.1137* 0.0023	1.0000
gdpgdecimal	0.1370* 0.0000	-0.0563 0.0941	-0.1155* 0.0011	0.0035 0.9244	-0.0825* 0.0062	0.1265* 0.0007	-0.0271 0.4026
inflationd~l	0.1090* 0.0007	0.0114 0.7355	-0.0928* 0.0090	0.0201 0.5808	-0.0426 0.1585	0.1126* 0.0025	-0.0168 0.6029
employment~l	0.0654* 0.0422	-0.0700* 0.0375	0.0116 0.7444	0.1458* 0.0001	-0.2005* 0.0000	0.0309 0.4084	-0.0404 0.2118
lngdpperca~a	-0.1199* 0.0002	0.0849* 0.0116	0.0962* 0.0068	-0.0721* 0.0477	0.3100* 0.0000	-0.0545 0.1454	0.0218 0.5000
gfc2008	0.0477 0.1391	0.0110 0.7432	-0.0342 0.3368	0.0550 0.1313	0.0072 0.8107	-0.0095 0.8003	0.0053 0.8706
gfc2009	-0.0038 0.9064	0.0255 0.4482	0.0009 0.9794	-0.0527 0.1480	0.0681* 0.0242	-0.0255 0.4949	-0.0122 0.7071

	gdpgde~l	inflat~l	employ~l	lngdpp~a	gfc2008	gfc2009
gdpgdecimal	1.0000					
inflationd~l	0.2409* 0.0000	1.0000				
employment~l	0.1748* 0.0000	0.2264* 0.0000	1.0000			
lngdpperca~a	-0.1824* 0.0000	-0.1584* 0.0000	-0.5231* 0.0000	1.0000		
gfc2008	0.0354 0.2330	0.3614* 0.0000	0.0037 0.9012	0.0742* 0.0122	1.0000	
gfc2009	-0.1698* 0.0000	-0.0284 0.3376	0.0091 0.7584	0.0633* 0.0329	-0.1311* 0.0000	1.0000

*represents significance at 95 percent confidence interval

Table C: *Hausman Test Results*

	Coefficients (b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
L.capitala~o	.3918108	.016874	.3749368	.1661806
L.returnon~s	-1.27834	-.5231338	-.7552067	.2224559
L.por~30days	-1.43924	-1.416368	-.0228711	.2198898
L.nonearni~l	1.171348	.6402265	.5311212	.2224584
sizelnta	.1871854	.1021453	.08504	.0711232
gdpgdecimal	1.490557	1.959573	-.4690156	.7810421
inflationd~l	.1819318	.6633981	-.4814663	.2618245
employment~l	-1.070746	-.4856991	-.5850471	1.835432
lngdpperca~a	-.4149814	.0226083	-.4375897	.1703475
L.lscale	-.4461942	-.2921271	-.1540671	.0604906
L.sscale	.3713677	.3380872	.0332805	.0557328
gfc2008	-.1605449	-.2329548	.0724099	.0263425
gfc2009	-.0005851	-.0366464	.0360614	.0100151

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(13) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 66.86
Prob>chi2 = 0.0000

Table D: *Test for Fixed Effects Vs OLS Estimator*

Fixed-effects (within) regression — Number of obs = 590
Group variable: mfiid — Number of groups = 130

R-sq: within = 0.2493 — Obs per group: min = 1
between = 0.0458 — avg = 4.5
overall = 0.1020 — max = 9

F(13,447) = 11.42
corr(u_i, Xb) = -0.5986 — Prob > F = 0.0000

glpgrowthr~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
capitalass~o						
L1.	.3918108	.2017217	1.94	0.053	-.00463	.7882516
returnonas~s						
L1.	-1.27834	.319682	-4.00	0.000	-1.906607	-.6500741
portf~30days						
L1.	-1.43924	.3365667	-4.28	0.000	-2.100689	-.77779
nonearning~l						
L1.	1.171348	.2772632	4.22	0.000	.6264464	1.716249
sizelnta	.1871854	.0767666	2.44	0.015	.0363171	.3380537
gdpgdecimal	1.490557	1.165353	1.28	0.202	-.7996943	3.780808
inflationd~l	.1819318	.4503172	0.40	0.686	-.70307	1.066934
employment~l	-1.070746	1.856562	-0.58	0.564	-4.719421	2.577928
lngdpperca~a	-.4149814	.1768492	-2.35	0.019	-.7625406	-.0674222
lscale						
L1.	-.4461942	.1016946	-4.39	0.000	-.6460531	-.2463353
sscale						
L1.	.3713677	.0912796	4.07	0.000	.1919773	.5507582
gfc2008	-.1605449	.0710883	-2.26	0.024	-.3002536	-.0208362
gfc2009	-.0005851	.0611441	-0.01	0.992	-.1207507	.1195805
_cons	.48673	1.615765	0.30	0.763	-2.688709	3.662169
sigma_u	.46101616					
sigma_e	.49500958					
rho	.46448789	(fraction of variance due to u_i)				

F test that all u_i=0: F(129, 447) = 1.90 — Prob > F = 0.0000