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Published online: 03 Jan 2023.

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Financial sustainability and capital leverage of microfinance institutions in China: The mediating role of profitability

Yue Li[1,2], Zariyawati Mohd Ashhari[1]* and Yaojun Fan[3]

Abstract: This study primarily investigates the effect of financial sustainability on capital leverage in microfinance setting. In doing this, this study looks at operating performance of 45 commercial microfinance institutions under current dual pressure of downturn and deleveraging in China. Empirically, this study employs the system GMM to observe a robustly small and negative impact of financial sustainability on capital leverage. Furthermore, this study presents a conclusion with evidence by mediation analysis that profitability exhibits a suppressing effect on the relationship between financial sustainability and capital leverage. Theoretically, this study verifies that the impact of financial sustainability on capital structure obeys the pecking order theory.

Subjects: Microeconomics; Econometrics; Development Economics; Finance; Public Finance; Banking

Keywords: Financial sustainability; capital leverage; profitability; microfinance institutions

1. Introduction

After more than 40 years of theoretical deepening and practical accumulation, the establishment of microfinance institutions (MFIs) with complete functions and systems is widely regarded as a panacea to eliminate financial constraints on poor and vulnerable groups excluded from services of conventional banking (Lopatta et al., 2017). This is a vital initiative to promote financial inclusion. In China, MFIs, as a crucial part of the construction of inclusive-financial service system, are of great significance for consolidating and expanding the effective connection between poverty alleviation and rural revitalization. In 2008, the China Banking Regulatory Commission issued *The Opinions on Adjusting and Relaxing the Access Policies of Banking Financial Institutions in Rural Areas to Better Support the Construction of New Socialist Countryside* and *The Guiding Opinions on The Pilot Project of Small Loan Companies (hereinafter referred to as the Opinions)*. According to the requirements of the Opinions, pilot projects of rural banks, rural mutual funds and other types of small loan companies have been actively carried out nationwide, marking the formal beginning of the development of MFIs in China. Among these new forces, commercial MFIs represented by small loan companies, including microcredit companies and microfinancing guarantee companies,[1] have risen rapidly during the pilot promotion period, and gradually become the main forces to specialize in financial inclusion. In a nutshell, with multi-level, broad coverage and moderate competition, the reform and development of commercial MFIs is conducive to the mechanism of financial inclusion for long-tailed market.[2] Whether from the perspective of Hayek's theory of partial knowledge or incomplete market theory, MFIs can help break the financial constraints of majority of small and medium-sized enterprises (SME) and ordinary self-employed household (Besley & Coate,

1995; Hayek, 2020; Stiglitz, 1989), thereby stimulating the endogenous development of the poor and establishing a long-term mechanism to solve relative poverty.

The relevant research shows that the core of microfinance commercialization development is to achieve commercial sustainability. However, microfinance of full welfare nature is highly dependent on external characteristics, so it cannot provide all-round and long-term financial support to poor and vulnerable groups (Lustig & Tommasi, 2020). Due to their historical background of serving the underprivileged, MFIs are largely reliant on donor funds. However, these funds are highly volatile and inadequate leading to financial unsustainability, which is likely to erode the quality of their future services. Thus, MFIs must strive for financial sustainability to meet their goals (Ghosh & Van Tassel, 2013). Financial sustainability regarded as an approach of securing future capital flow can be achieved via commercialization and competition of micro-lending services, especially for current shortage in procurement of subsidies and donations (Abate et al., 2013; Chakravarty & Pylypiv, 2015). It can be seen that in the context of commercialization, in order to continue sustainable development, MFIs should strengthen their capital structure management.

Modigliani and Miller firstly introduce the content of capital structure on a firm's value. They suggest the levered firm has a higher value than unlevered within tax consideration (Modigliani & Miller, 1963). This content is important for financial institutions as well followed by Berger et al. (1995). With the research progressed, capital structure has evolved into several theories. Among them, trade-off theory predicts firm to determine leverage by trading-off between the tax shield of debt financing and cost of financial distress, including debt cost (Myers, 1984). On the other side, pecking order theory emerged that explains that the more sustainable firm relies less on debt owing to higher capacity of internal financing. The more reliance on external financing by less fortunate firm will lay an underlying danger of future debt crisis (Vasiliou et al., 2009). Apparently, there is a great debate among scholars on whether to leverage or not.

As Pettis (2013) had ever described that, "Investments were misallocated on a tremendous scale in China", a storm of negatives which were companied with the extensive economy had been intentionally or unintentionally ignored. To handle this misallocation, since 2014, the process of economic transition along with economic downturn primarily conducted pressure of deleveraging on financial sector. Deleveraging is an important measure to seek economic transformation in the context of economic downturn. By balance sheet reduction of financial institutions, it guides financial institutions to diversify their lending orientation away from over-indebted sectors towards less indebted ones. It aims to solve misallocation and drive emerging industries becoming a new force for the economy (K. Chen et al., 2022). However, commercial MFIs, which can operate credit-only businesses, are seen as low-credit and high-risk institutions, since their borrowers are more vulnerable in the current economic downturn. Therefore, it is extremely difficult for MFIs to obtain external financing (Wang & Ran, 2019). In order to have sufficient capital flow, microfinance institutions can only adopt defensive business strategies, that is, to reduce loan issuance and to focus on collection of outstanding loans. According to statistics disclosed by the Central Bank, the loan balance of small loan companies has decreased year by year from the peak of 942 billion yuan in 2014 to 888.8 billion yuan in 2020. The data seem to indicate a weakening of the MFIs' role in financial inclusion. Paradoxically, lightly indebted microloan borrowers, who are supposed to be the beneficiaries of economic transition, are trapped by deleveraging policies. However, this problem has not been taken seriously. This problem leads to a deeper consideration that the sustainable development and capital structure of microfinance institutions matter for their ability to practice financial inclusion.

In China, microfinance sector, as the vital channel to implement financial inclusion, is mainly in the form of commercialization (for-profit). However, compared with traditional banking, MFIs have defects in external debt financing (Visconti, 2016). The context of deleveraging policy and economic downturn further widens the financing gap of MFIs. In response to this dilemma, it is in urgent need of MFIs to improve sustainability within economic uncertainties while sustainability

appears to initiate self-support financing. Thus, the growing concern about profitability obviously becomes the overwhelming choice of MFIs to maintain "self-loop" capital, though this would defeat the original intention of poverty alleviation to some extent. Aimed at this, little is known about the extent to which whether to weaken rely on capital leverage should be necessary for MFIs in pursuit of sustainability, as well the role that profitability plays therein. This study probes into the evidence on what impact of MFIs' financial sustainability on their leverage strategy and what role the profitability plays in the relationship between financial sustainability and capital leverage.

2. 2. Literature review and hypothesis development

2.1. Theoretical review

This section in order for underpinning the present study to construct a logical theoretical framework of capital structure via discussing and integrating two theories: pecking order theory, trade-off theory. An understanding of the theoretical explanation is deemed vital as it makes apparent the related parties' involvement within implications on capital leverage. The following paragraphs will discuss these theories in more detail.

The pecking order theory suggests that firms have a particular preference order for capital used to finance their businesses (Myers & Majluf, 1984). Owing to the theory of information asymmetry and considering the existence of transaction costs, managers have more inside information than investors and act in favor of old shareholders. When firms are financing for new projects, they will give priority to using internal earnings, then use debt financing, and finally consider equity financing (Gaud et al., 2005; Mazur, 2007). Thus, holding other factors constant, firms that generate more earnings should use less debt in their capital structure.

Trade-off theory deems that the firm determines the ratio of debt financing to equity financing by weighing the advantages and disadvantages of debt. The benefits of debt include tax savings, namely tax shield. The cost of debt refers to the cost of financial distress (Myers, 1984). Consequently, the lower costs (including bankruptcy costs and tax shield) are needed to burden, the more debt in capital structure should be expected, and vice versa (Matemilola et al., 2019). Trade-off theory suggests firm should weigh the benefits and costs of debt, so as to choose the appropriate leverage.

In sum, trade-off theory supports that lower cost of debt stimulates the use of leverage, while pecking order theory endorses an aversion to leverage based on consideration of information asymmetry. Although these theories clarify the determinants of capital leverage from different perspectives, the impact of financial sustainability on capital leverage is still blank. However, from the perspective of survival, financial sustainability undoubtedly has a crucial impact on use of capital leverage. This study combining with reality advocates capital leverage as the least preferred way of funding and expects less use of debt in line with sustainability, because the downward economy should boost self-financing by MFIs in priority to keep free capital flow and avoid stepping into financial distress rather than access to extreme leverage.

2.2. Empirical review

2.2.1. Financial sustainability and profitability

The concept of sustainability originates from natural science where it refers to the ability of a society ecosystem or any such ongoing system to continue functioning into the indefinite future without being forced into decline through exhaustion of its key resources (Cook & Robèrt, 1990). Sustainability in MFIs refers to the ability of institutions to cover their operating costs using operating revenue generated from their core activities (Ledgerwood, 1999; Woller et al., 1999). In this respect, the strong sustainability with fair profitability can be achieved when the institutions are able to reduce their transaction costs, offer better products and services that meet clients need, generate enough revenues as well innovate more financing ways for the unbaked poor

households (CGAP, 2004). Ayayi and Sene (2010) propose operational sustainability (OSS) for microfinance sustainability that MFIs cover the operating costs including financing costs. At present, MFIs can receive very low subsidies compared to their funding demands on background of commercialization. Thus, a simple truth must be aware of the significance of sustainability and profitability.

Much of time, however, sustainability and profitability mutually check and balance each other. To what extent should MFIs focus on sustainability versus profitability is a challenge on leverage adjustment. By investigation on 52 MFIs in Ghana from 1995 to 2004, Kyereboah-Coleman (2007) discovers that highly leveraged MFIs are easy access into profitability and outreach to breadth, and inversely harmful to sustainability and outreach to depth. They claim that chasing financial performance by reaching out to more clients takes leverage in account for guaranteeing enough funds. Simultaneously, financial burden and bankruptcy risk are unintentionally aggravated owing to incessant leveraging. Ibrahim et al. (2018) also give an explanation in the view of mission on financial inclusion via a sample of 57 MIFs from the member countries of the Organization of Islamic Cooperation. Despite the fact of financial sustainability, they suggest MFIs should be in line with ethical operations. The unethical hunger of profit growth by charging high interest rates may result in mission drift, because MFIs expect to rapidly transfer their financing costs and eliminate the risks of leverage. However, cost efficiency cannot determine profitability and sustainability, due to no intrinsically better microfinance approach between for-profit and not-for-profit MFIs (Leite & Civitarese, 2019). In a consideration of MFIs' social mission on financial inclusion, MFIs ought to maintain fair profit for sustainability, rather than endlessly chasing profitability (Hudon et al., 2020).

2.2.2. Profitability and capital leverage

The sustainable view of capital structure asserts that financial institutions hold a level of capital adequacy for risk buffer. This requires minimization of the equity costs that arise from information asymmetries (Myers, 1984; Myers & Majluf, 1984). MFIs which maintain a high level of buffer capital are less levered. According to the pecking order theory, Degryse et al. (2012) deploy the evidence of Dutch small and medium-sized enterprises (SMEs) from 2003 to 2005, to prove that sustainable MFIs confront with lower cost in rising their equity when access more SMEs, as well high profits further stay away from necessity to raise leverage. Whilst Towo et al. (2019) emphasize the importance of debt financing for MFIs operation, they are adamant that financial leverage aggravates financial burden of MFIs, further leading to liquidation or takeover, as MFIs are compelled to spend or suspend fragile future cash flows to meet debt obligations. Siddik et al. (2017) employ panel data of 22 banks in Bangladesh from 2005 to 2014 to conclude that excessive debt worsens capital structure. They recommend banking to optimize capital structure by reducing reliance on debt. Adusei and Obeng (2019) carry out a dataset of MFIs from a global perspective to investigate the nexus between capital structure and performance. Their findings stand on the position of pecking order theory with some credence as well as indicate that profitability is negatively associated with leverage level.

The findings debated by existing literatures are largely mixed. Some scholars stand against the views above. Adusei and Sarpong-Danquah (2021) come to a contrary view on sustainable development. They utilize trade-off theory to explain that if in a good institutional quality, due to more tax savings, the better opportunity for MFIs to profit accelerates more use of debts, vice versa. Bitok et al. (2021) examine the impact of agency cost and capital structure on MFIs in Kenya with panel data model regression on a sample drawn from 30 MFIs during the period 2010–2018. They suggest prudent raise in capital leverage in virtue of that profitable MFIs boost investor confidence through strategic decision-making. These findings are similar to the study by Kar (2012) that a positive nexus between profit-efficiency and capital leverage is confirmed with evidence of 92 cross-country MFIs.

From the existing literature, many studies on microfinance contribute their demonstrations that profitability has an important impact on capital leverage, and there is a close relationship between

financial sustainability and profitability, but what is the impact of financial sustainability on capital leverage? As far as we know, the elaborations on this question are rare. In addition, profitability seems to play a conductive role in the relationship between sustainability and capital leverage. Little know how profitability plays therein. In doing these, we propose the hypotheses are:

H_a: There is no significant effect of financial sustainability on MFIs' leverage decision in China.

H_b: Profitability does not mediate the relationship between financial sustainability and capital leverage.

3. Sample and data source

The commercial MFIs in China are classified into small loan companies, including microcredit companies and microfinancing guarantee companies. Although the number of population is huge, many of them limit in disclosure and financial records. In an effort to obtain as valid and complete data as possible, in addition to collecting from Wind Database which is the widely acceptable financial database, we also combine public financial reports to fill in missing value. Besides, this study applies macro data from the National Bureau of Statistics as well. To this end, the data set for this study originates from panel data of 45 commercial MFIs, including 35 microcredit companies and 10 microfinancing guarantee companies in the mature period of 2012–2020, and their local economic conditions of provinces or municipalities. Although the sample size is small compared to the population, these 45 MFIs can represent the mature group with consideration of late start of most of commercial MFIs. And these samples are geographically dispersed. Therefore, the sample is adequate for refracting the whole.

4. Methodology

The literature commonly mentions that financial sustainability is significant for the decision on capital structure, but cannot yet form a unanimous conclusion about its impact. To achieve the objectives of this study, this section examines the research hypotheses proposed in previous section by modelling.

4.1. Model specification

In analysis of MFIs, the heterogeneity caused by the difference in earnings management between for-profit and non-for-profit MFIs must be concerned (Pignatel & Tchuigoua, 2020; de Oliveira Leite et al., 2020). It is worth noting that commercial MFIs operate in profit orientation. Therefore, this study screens commercial MFIs as samples which naturally eliminate the problem of heterogeneity. Furthermore, it can be found from both practical and academic studies that the change in sustainability will cause dynamic adjustment of leverage. This requires analysis not only to consider the influence of current factors, but also to account for the influence of past factors. Hence, it is necessary to add the lag term of the explained variable to the explanatory variable. As for possibility of endogeneity, we use the generalized method of moment (GMM) estimation in the dynamic panel model for empirical analysis (Pacifico, 2020). GMM can not only overcome obstacles of weak instrumental variables and endogeneity, but also improve the efficiency of estimation.

In addition, credited to Arellano and Bover (1995), the system GMM estimator uses moment conditions (instruments) that do not correlate with the regressors in the estimated model. We use a collapse technique to avoid the proliferation of instruments. We rely on two statistics to test the reliability of results obtained from this estimator: Arellano-Bond autocorrelation test and Hansen statistic. The former is used to test for serial correlation of the error term and the latter checks the validity of the instruments used.

4.1.1. Regression of main effect

This section implements the three-step approach to set a test for mediating effects. To empirically test hypothesis H_a: the impact of financial sustainability on leverage, we include a baseline regression to construct Path A in Equation 4–1.

$$Y_{i,t} = a_1 Y_{i,t-1} + a_2 OSS_{i,t} + \partial_\tau X_{control\ i,t} + a_3 d_i + \varepsilon_{i,t} \qquad (4-1)$$

Where, $Y_{i,t}$ is introduced as dependent variables that measures the capital structure (regarding as capital leverage expressed by debt-to-equity ratio) for one particular MFI during a specific year.

On the other side, $Y_{i,t-1}$ is the first-order lag of explained variable; a_1, a_2 and a_3 are coefficients of independent variables to be estimated; ∂_τ is the coefficient of vector formed by control variables; and $\varepsilon_{i,t}$ is the error term. This model launches the accounting measurement of core explanatory variable: operational self-sufficiency (OSS) that reflects the ability to compensate operating costs by operating incomes (Ayayi & Sene, 2010). The main problem affecting financial sustainability is the efficiency of the use of funds rather than the source of funds (Okumu, 2007). This study following Okumu's conclusion concentrates uniquely on financial sustainability as OSS because the objective is to examine capital structure in the sense of efficiency of funds use. A better sustainability excercises less expenditures on financing and loads on less pressures on investment decisions (Pratomo & Ismail, 2006). The great sustainability is expected to decrease leverage.

The third term in the model $\partial_\tau X_{control\ i,t}$ represents the sets of variables as control variables. Firstly, this model introduces real GDP growth rate (RGDP) and inflation rate (INF) as the essential macro variables for MFIs' performance. Both two macro variables commonly indicate regional economic conditions of provinces or municipalities where MFIs are located.

The market structure is also involved in control variables. Wherein, geographic branch penetration (GBP) measured by regional branches of MFIs per 10 km^2 and demographic branch penetration (DBP) measured by regional branches of MFIs per 10 thousand capita, both are computed as nature logarithm to imply microcredit service coverage and competition status (Beck et al., 2007; Cull et al., 2009; Vanroose & D'Espallier, 2013). The higher value of these indicators, the more competition of there is in market. Besides this, in line with McKinsey Matrix, society's leverage (SLEV) computed by the ratio of total credit issued by financial institutions for other sectors of society to regional GDP, reflect the size of credit gap and the extent of credit saturation (Yao & Liu, 2018). More competition and deeper saturation in credit market, the less space there is for microfinance.

Next, some specific variables work for the control vector. Size of assets (SIZE), measured as the nature logarithm of total assets, indicates MFI's strength in favor of long-term operation (Al-Kayed et al., 2014). Subsequently, net loans ratio (NLR) ratio represents the ability of generate revenues (Alshatti, 2015), and non-earning assets ratio (NEAR) indicates that how much of assets is used for commitment of assets security rather than investments or other purposes (Akuetteh, 2019). Apart from these variables, some scholars generally believe that gender is an important factor affecting the asset quality of microfinance institutions (Afrifa et al., 2019; Fayyaz & Khan, 2021; Gyapong et al., 2021), as there is evidence that lending to female borrowers is associated with better loan performance than it is the case with male borrowers, but it seems to be an illusion that gender heterogeneity can determine the bias of MFIs' capital-loan portfolio (X. Chen et al., 2020; Leite & Civitarese, 2019). Therefore, this study excludes gender as a specific variable.

Followed by the control vector, the fourth term d_i represents a dummy variable (MCC) is used to distinguish the types of MFIs, where MCC takes the value 1 or 0 to manifest microcredit companies or microfinancing guarantee companies respectively. All these variables used in regression are summarized in Appendix Table A1.

4.1.2. Regressions of mediating effect
To test the mediating effect of profitability on sustainability and leverage, based on Path A above, we look at coefficient a_2 without adding mediator firstly to test if MFIs lessen the use of leverage in accordance with achieving sustainability. Then, through Path B, we inspect the estimated

coefficient b_2 of sustainability on the mediator. Finally, the Path C with adding mediator offers the observation of the effects of sustainability and mediator commonly on leverage, i.e. estimated coefficients c_2 and c_3. The mediating regressions for Path B and Path C are formulated in Equation 4–2 and Equation 4–3 respectively.

$$Mediator_{i,t} = b_1 Mediator_{i,t-1} + b_2 OSS_{i,t} + \gamma_\tau X_{control\ i,t} + b_3 d_i + \varepsilon_{i,t} \tag{4-2}$$

$$Y_{i,t} = c_1 Y_{i,t-1} + c_2 OSS_{i,t} + c_3 Mediator_{i,t} + \varphi_\tau X_{control\ i,t} + c_4 d_i + \varepsilon_{i,t} \tag{4-3}$$

Where the mediators indicate the profitability including return on assets (ROA) and return on equity (ROE) in modelling. ROA and ROE are regarded as the ability to generate revenue through utilizations of assets and capitals respectively (Al-Kayed et al., 2014; Dawar, 2014).

Given the regression results of Equation 4–2 and 4–3, when the coefficient a_2 in Path A, coefficient b_2 in Path B and coefficient c_2 in Path C are significant, and c_3 is not significant, the mediator contributes a complete mediating effect. If the coefficient c_2 in Path C is significantly smaller than a_2 in Path A, there exists the partial mediating effects. Synchronously, the Bootstrap test can assist us to check whether mediating effect ($b_2 * c_3$) and direct effect (c_2) are significant, as well estimate whether their confidence interval contains 0 (Fritz & MacKinnon, 2007; MacKinnon et al., 2004; Tofighi & MacKinnon, 2011). The structure of mediating effect in our model is exhibited in Figure 1. All these models introduced in this section are implemented within realistic data set through software Stata V.16.0.

5. Empirical results and discussion

5.1. Data description
To answer questions of this study, the statistics for formed sample are presented in Table 1 firstly in the light of variables of interest we constructed. There is not any variable with high standard deviation reported that indicates the values of data set in all indicators are close to means. It is more likely to obey normal distribution on the whole.

Then, this study continues to check if multicollinearity is possible for variables within the sample period. Table 2 demonstrates the correlation of independent variables included in the model introduced above. In Table 2, a great correlation between ROA and ROE at 0.982 and significant at 1% predict a suspected multicollinearity. To further confirm for possible multicollinearity, we apply the Variance Inflation Factor (VIF) test. The VIF values of ROA and ROE at 34.62 and 34.93, respectively, are both greater than the benchmark of 10 that a strong multicollinearity detected is convincing to be the truth.

Some studies propose the use of principal component analysis (PCA) as a statistical technique for quantifying and adjusting multicollinearity in a data base (Adnan et al., 2006; Perez, 2017;

Figure 1. Mediation model (Note: total effect is a_2, direct effect is c_2 and mediating effect is $b_2 * c_3$**).**

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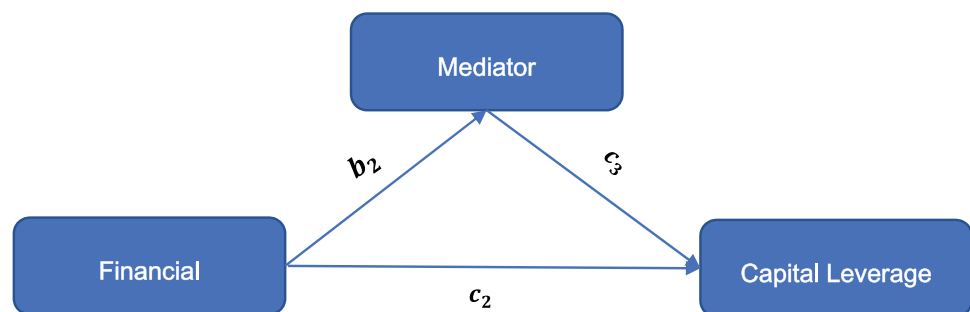
Table 1. Descriptive statistics					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
VARIABLES	**Observation**	**mean**	**standard deviation**	**min**	**max**
LEV	405	0.279	0.280	0.00120	1.605
OSS	405	1.782	1.224	0.0173	9.456
ROA	405	0.0545	0.0721	−0.598	0.167
ROE	405	0.0700	0.0838	−0.708	0.221
RGDP	405	0.0757	0.0239	0.00500	0.136
INF	405	0.0217	0.00544	0.00600	0.0390
SLEV	405	1.423	0.337	0.740	2.360
NLR	405	0.731	0.289	0.00570	1.174
NEAR	405	0.116	0.145	0.000116	0.622
lnSIZE	405	6.350	1.504	4.330	10.32
lnGBP	405	−0.966	1.008	−5.260	2.054
lnDBP	405	−0.137	0.520	−1.237	1.764
MCC	405	0.778	0.416	0	1
Number of samples	45	45	45	45	45

Table 2. Correlation matrix							
	OSS	**ROA**	**ROE**	**RGDP**	**INF**	**SLEV**	**lnGBP**
OSS	1						
ROA	0.300***	1					
ROE	0.275***	0.982***	1				
RGDP	0.145***	0.252***	0.289***	1			
INF	−0.0570	−0.099**	−0.107**	−0.0660	1		
SLEV	−0.106**	−0.126**	−0.122**	−0.468***	0.0480	1	
lnGBP	−0.0010	−0.0640	−0.0570	−0.0740	0.0390	0.224***	1
lnDBP	−0.083*	−0.0720	−0.0670	−0.212***	−0.103**	0.583***	0.670***
NLR	0.124**	0.169***	0.129***	0.0350	0.0310	−0.128***	−0.0650
NEAR	−0.122**	−0.0460	−0.0110	0.095*	−0.0350	0.0330	0.00500
lnSIZE	−0.0650	−0.111**	−0.0420	0.0740	−0.0750	0.189***	0.188***
	lnDBP	**NLR**	**NEAR**	**lnSIZE**			
lnDBP	1						
NLR	−0.0790	1					
NEAR	0.0210	−0.758***	1				
lnSIZE	0.211***	−0.725***	0.521***	1			

\# Stars next to the correlation coefficient indicate the level of significance, *** significant at 1%, ** significant at 5%, and * significant at 10%.

Sulaiman et al., 2021). PCA by simplifying data set is a dimensionality reduction process that converts multiple indicators into a few comprehensive indicators with a linear change. In our study, ROA and ROE are the main indicators for profitability of MFIs. Hence, the multicollinearity can be solved by reducing the dimension of these two indicators into a comprehensive indicator (PROFIT) that results of adjusted correlation is shown in Table 3. After VIF test with adjusted variables again, there is no longer existing evidence of multicollinearity among adjusted variables.

Table 3. Adjusted correlation matrix							
	OSS	**PROFIT**	**RGDP**	**INF**	**SLEV**	**lnGBP**	**lnDBP**
OSS	1						
PROFIT	0.288***	1					
RGDP	0.145***	0.272***	1				
INF	−0.0570	−0.104**	−0.0660	1			
SLEV	−0.106**	−0.125**	−0.468***	0.0480	1		
lnGBP	−0.0010	−0.0610	−0.0740	0.0390	0.224***	1	
lnDBP	−0.083*	−0.0690	−0.212***	−0.103**	0.583***	0.670***	1
NLR	0.124**	0.150***	0.0350	0.0310	−0.128***	−0.0650	−0.0790
NEAR	−0.122**	−0.0280	0.095*	−0.0350	0.0330	0.00500	0.0210
lnSIZE	−0.0650	−0.0770	0.0740	−0.0750	0.189***	0.188***	0.211***
	NLR	NEAR	lnSIZE				
NLR	1						
NEAR	−0.758***	1					
lnSIZE	−0.725***	0.521***	1				

5.2. Baseline regression results

The baseline regression in this study uses the system GMM estimation method, and selects the first-order lag of the explained variable as the exogenous variable. In order to ensure the reliability of the GMM estimation results, this study also tries the static panel fixed effect (FE) model for estimation. Table 4 shows the baseline regression estimation results where the explained variable is the leverage ratio and the core explanatory variable is financial sustainability.

As shown in Table 4, the Hausman test (p = 0.0002) mentions that there is a significant difference in coefficient estimation between fixed and random effects. The fixed effect better matches modelling. The first column is the estimation result of the panel fixed effect model. The result implies that financial sustainability opposes MFIs to raise the extent of debt financing, and it is significant at the 1% level. While considering the endogeneity, the estimation results of the GMM are shown in the second column. Sustainability still has a suppressive effect on the behaver to leverage of MFIs with a significance level at 1%, and the influence coefficient is larger, which becomes −0.055, indicating that no matter whether static panel estimation or dynamic panel estimation is used, sustainability has a significant negative effect on leverage. Both obey the pecking order theory looking upon debt financing as the least preference order. However, the endogenous term will underestimate the inhibiting effect of sustainability on the leverage. Therefore, the system GMM estimation method should be better for estimating the relation between sustainability and leverage within Equation 4–1. Even so, financial sustainability has the least impact on capital leverage compared to other independent variables.

In the system GMM estimation, the P value of Arellano-Bond test for AR (1) in first differences is less than 1 %, and the P value of AR (2) test is more than 10 %; that is, the regression does not exist second-order sequence autocorrelation, indicating that the model effectively overcomes the endogeneity problem. The Hansen test reports that the instrumental variables selection of the model is reasonable, and the results of regression appear to be unbiased while GMM is applied to estimate the effects. Following the second column of Table 4, the impact of the first-order lag of the leverage on current leverage is significant at 0.548, indicating that the leverage in previous period of MFI has a significantly promoting effect on the current leverage. By implication, along with improvement of financial sustainability, MFIs are able to get rid of reliance on debt, as well as curtail the burden of financing cost and facilitate quality of capital structure. This goes against the trade-off theory of insisting that lower cost in debt financing.

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Table 4. Results of baseline regression		
	(1)	**(2)**
VARIABLES	**LEV(FE)**	**LEV(GMM)**
L.LEV		0.548***
		(27.13)
OSS	−0.017***	−0.055***
	(−2.70)	(−5.63)
RGDP	−0.283	−0.393
	(−0.39)	(1.01)
INF	0.418	1.420*
	(0.23)	(1.76)
SLEV	−0.406***	−0.180***
	(−3.87)	(−3.83)
lnGBP	0.302	−0.126***
	(0.43)	(−4.84)
lnDBP	−0.381	0.151***
	(−0.52)	(4.05)
NLR	−0.151	−0.299**
	(−0.86)	(−2.29)
NEAR	−0.124	−0.335**
	(−0.74)	(2.60)
lnSIZE	0.263***	0.041***
	(3.34)	(4.17)
MCC		0.296***
		(3.20)
Hausman test	0.0002	
AR(1)		0.003
AR(2)		0.114
Hansen test		0.437

\# Baseline model estimated by fixed effect and GMM regression techniques.

t-statistics in parentheses, ***$p < 0.01$, **<0.05, *$p < 0.1$.

As for the effects of control variables, local inflation index significantly scales up the debt burden of MFIs, while GDP growth ease the MFIs' debt positions without a significant effect. This agrees with the conclusion of Adusei and Sarpong-Danquah (2021), that the quality of external conditions slows down capital structure of MFIs in line with the pecking order theory. From the perspective of market structure, the scale of aggregate social indebtedness and geographic distribution density of financial institutions jointly report the market competition pressure against expansion of leveraging for business within a saturated condition. Unexpectedly, the demographic coverage density of financial institutions promotes the leverage of MFIs. The likely reason is that the lower costs of information and transaction in a buoyant lending environment trigger more aggressive leverage strategy acted by MFIs, despite intensifying competition.

In respect of specific characteristics, with the increase in assets scale, the ability of MFIs to leverage also raises. It is worth noting that the proportion of outstanding loans negatively affects the use of debts by MFIs. Along with business scale growth, the aversion to debt deepens, that contradicts agency theory. From a security standpoint, the priority shifts over time to holding non-earning assets as business growth. Priority of recoverable non-earning assets further dispels desires of MFIs to capital leverage. This supports the preference of self-sufficiency by the pecking

order theory. In addition, the dummy variable (MCC), which indicates different types of MFIs, is positive to leverage. This reflects that microcredit companies are more leveraged accept than microfinancing guarantee companies.

5.3. Robust test

This study covers commercial MFIs as the sampling range, including microcredit companies and microfinancing guarantee companies. Among them, microcredit companies are regarded as the main sampling objects. Although we have control over type variable (MCC), it is suspected whether the regression model for synthetic types is still valid for the primary observations. Towards this end, we run the baseline regression only with observations of microcredit companies. The estimated results report an impact of financial sustainability on capital leverage up to −0.0199, strongly significant at 1%, and this regression test can success in Arellano-Bond test and Hansen test. This demonstrates that the baseline model is still robust in a single type of sample.

Moreover, this study introduces regional conditions as MFIs' external control variables. Considering that the municipality-level data is far greater than the province-level data in terms of economic prosperity and competition intensity, we exclude the influence of the MFIs located in the municipality on the model to test if robust. The test likewise indicates that the baseline model is robust with the influence coefficient of core explanatory variable (OSS) at −0.0218 and significant at 5%.

Similarly, this study varies control variables in three levels (macro variables, market structure variables and institution-specific variables) that the results may exist instability. It's necessary to test if robust excluding the influence of macro variables. The coefficient of OSS is −0.0223 and significant at 1% without macro variables. It declares that the model running variables in different level is still robust.

5.4. Mediation results

In this study, profitability (PROFIT) is applied as mediating variable to test the mediating effect. Following the results of Table 4, in the Path A, we can extract the total effect that is significant effect of financial sustainability on leverage, a_2, at −0.055 in line with baseline regression in Equation 4–1. By regression of Equation 4–2, Path B obtains a significantly positive effect of financial sustainability on profitability, b_2, at 0.190. With insight of Path C in the light of Equation 4–3, the results reveal that both sustainability and profitability have significant impacts on leverage, where the direct effect c_2 is −0.090 and the influence coefficient c_3 is 0.064. In light of Bootstrap test, the indirect effect (mediating effect) is significant at 95% confidence interval between 0.00274 and 0.0105, without involvement of 0. Followed by computing, The indirect effect is $b_2 * c_3 = 0.01216$. As indirect effect has a different sign as direct effect, i.e. indirect effect is positive and direct effect is negative, a suppressing effect can be ascertained in the model and its proportion equals to $\left| \frac{b_2 * c_3}{c_2} \right| = 0.1351$. All results of mediation are exhibited in Table 5.

Financial sustainability has a small and positive effect on profitability can be examined by Path B. This reflects that financial sustainability can allow MFIs to create fair profit by consistent commercial activities. In addition, the ability of leveraging is stronger as along with as along with profit growth that can be proved by the positive influence coefficient of PROFIT in Path C. As the coefficient of OSS in Path A is greater than it in Path C, at the same level of sustainability, the leverage without considering the impact of profitability is higher than that with considering the impact of profitability. This verifies profitability conduct a suppressing impact on the nexus between sustainability and leverage. It can be concluded that some reliance on external debt financing can be further offset by earnings generated by profit growth. This, likewise, proves that the impact of financial sustainability on capital structure follows the pecking order theory on the priority of internal earnings.

Table 5. Results of mediation model			
	Path A	**Path B**	**Path C**
VARIABLES	**LEV**	**PROFIT**	**LEV**
OSS	−0.055***	0.190***	−0.090***
	(−5.63)	(4.06)	(−7.61)
PROFIT			0.064***
			(5.40)
L.PROFIT		0.673***	
		(30.32)	
L.LEV	0.548***		0.496***
	(27.13)		(20.31)
AR(1)	0.003	0.008	0.001
AR(2)	0.114	0.515	0.161
Hansen	0.437	0.130	0.325
Control variables, period	Control	Control	Control
Range of indirect effect (Bootstrap)	[0.0027444 ~ 0.0104675]		Z = 3.35 p = 0.001
Range of direct effect (Bootstrap)	[−0.0534295~−0.015783]		Z = −3.60 P = 0.000

\# Mediation model estimated by three-step GMM regression technique. t-statistics in parentheses, ***p < 0.01, **<0.05, *p < 0.1.

6. Conclusion and implication

This study investigates the impact of financial sustainability on MFIs' capital structure based on the balanced panel data set during period of 2012–2020 of commercial MFIs in China by using the system GMM method. It gives a particular focus to the mediating role of profitability on the relationship between financial sustainability and capital leverage. This study provides a new perspective for deeply excavating the theoretical basis for MFIs' capital structure. The findings are presented as follows: First, financial sustainability significantly weakens the reliance on capital leverage. Second, financial sustainability significantly enhances the fair profit of MFIs. Third, profitability can suppress the effect of financial sustainability on capital leverage so that sustainable MFIs deepen aversion to leverage along with profit growth. Fourth, financial sustainability determines the capital structure in light of the pecking theory.

Therefore, based on the findings above, this study proposes the following recommendations. First of all, MFIs should scientifically rule the external debt scale and strengthen the sustainable and healthy development. To do this, MFIs should sound their internal management and operation mechanisms. While accelerating loan turnover and arranging loan maturities reasonably, it also innovates asset diversification, improves liquidity and revitalizes outstanding loans and reduces non-performing loans. By practicing "small and decentralized" lending, MFIs can operate efficient microloans for more micro borrowers and consolidate self-financing ability, so that their headwinds of debt will fade. Secondly, the profitable MFIs should benefit their micro borrowers by reducing interest charge on the premise of ensuring fair profits. In the way of surrendering profits, MFIs can improve their repayment rate and establish creditworthiness so as to lessen transaction costs of external financing. Thirdly, policymakers should moderately release deleveraging stress in terms of the operating status of MFIs. Policymakers can screen some creditable MFIs as a plot to broaden them financing channels such as bill market and inter-banking market, as well as encourage consistently profitable MFIs to list on National Equities Exchange and Quotations. Fourth, policymakers should allow the MFIs which operate in good conditions to cross-regional operation. With preferential policies and relevant subsidies, policymakers can not only guide MFIs to access into underdeveloped region, but also ease regional competition of financial saturation.

Does financial sustainability decelerate raise in leverage of MFIs because it improves operating efficiency in such a way that MFIs become more self-sufficient away to offset the gap in external financing? And does the similar circumstance occur in deposit-taking MFIs with deposit liabilities as their main funding sources? These matters are not mentioned herein. Further research is needed in this direction to answer these questions.

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Citation information
Cite this article as: Financial sustainability and capital leverage of microfinance institutions in China: The mediating role of profitability, Yue Li, Zariyawati Mohd Ashhari & Yaojun Fan, *Cogent Economics & Finance* (2022), 10: 2153411.

Notes
1. Microcredit companies piloted in 2008 by *Guiding Opinions on the Pilot Operation of Microcredit Companies No. 23 [2008] of China Banking Regulatory*; and financing guarantee companies launched since 2010 by *Interim Measures for the Administration of Financing Guarantee Companies NO. 3 [2010] of the China Banking Regulatory*. Both of them cannot absorb deposits and specialize in microcredit services for small and medium customer groups.
2. Long-tailed market regarded as a whole, in which amounts of scattered financing demands are excluded by conventional banking, can match the main financial market.

Disclosure statement
No potential conflict of interest was reported by the author(s).

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Table A1. Summary of variables		
VARIABLES	**SYMBOL**	**DESCRIPTION**
Capital leverage	LEV	*Total Liabilities$/$Total Equity*
Financial Sustainability	OSS	$\frac{Operating\ Income}{Operating\ Expenses\ +\ Capital\ Costs\ +\ Loss\ Reserves}$
Real GDP Growth	RGDP	$\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$
Inflation	INF	$\frac{CPI_t - CPI_{t-1}}{CPI_{t-1}}$
Society's Leverage	SLEV	$\frac{Total\ Credit\ by\ Financial\ Sector}{GDP}$
Geographic Branch Penetration	lnGBP	$log(amount\ of\ MFIs\ branches\ per\ 10\ km^2)$
Demographic Branch Penetration	lnDBP	$log(amount\ of\ MFIs\ branches\ per\ 10\ thousand\ capita)$
Net Loan Ratio	NLR	$\frac{Total\ Loans\ -\ Provisions}{Total\ Assets}$
Non-earning Assets Ratio	NEAR	$\frac{Cash\ and\ Cash\ Equivalents\ +\ Tangible\ Assets}{Total\ Assets}$
Size of Assets	lnSIZE	$log(Total\ Assets)$
Types of MFIs	MCC	A dummy variable takes value of 1 if the particular MFI is microcredit company and 0 otherwise
Mediator: Profitability (PROFIT)	ROA	$\frac{Net\ Operating\ Income_t\ -\ Taxes_t}{Total\ Assets_t - TotalAssets_{t-1}}$
	ROE	$\frac{Net\ Operating\ Income_t\ -\ Taxes_t}{Total\ Equity_t\ -\ Total\ Equity_{t-1}}$

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