



## ARTICLE

# Impact of Loan Portfolio Characteristics on Microfinance Institutions: The Case of Morocco

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### Abstract

This paper identifies how loan portfolio characteristics impact the financial performance and sustainability of Moroccan microfinance institutions (MFIs). Using the Mix Market dataset, fixed and random panel regression models were adopted to analyze six Moroccan MFIs between 2003 and 2018. These models analyze the impact of loan portfolio size, type, risk, return, management effectiveness, write-offs, and recoveries variables on MFIs' return on asset (ROA), return on equity (ROE), and operational self-sufficiency (OSS). As a set of proxy variables is used to measure each loan portfolio characteristic, empirical findings indicate that the nature of the relationships between these variables and the dependent variables varies. Findings indicate that MFIs' profitability and sustainability are positively impacted by many variables that include the number of outstanding loans, gross loan portfolio for enterprise financing, and portfolio at risk 90. Results also reveal that the dependent variables are negatively impacted by variables, which include write-offs, the number of borrowers per staff member, and the number of loans per loan officer.

**Keywords:** Microfinance institutions, Panel Regression, Loan Portfolio, Morocco

**JEL classification:** G00, G21, G51

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## 1. Introduction

Microfinance institutions (MFIs) are a form of institutions that were created to reduce the exclusion of low-income individuals from formal and conventional financial systems (Brau & Woller, 2004). To handle several economic issues in Morocco that relate to economic growth, economic development, poverty, and unemployment, the microfinance sector was launched during the early 90s (Benouna & Tkiouat, 2016). The first Moroccan MFI was initially launched and tested in the rural region of the Middle Atlas near Khenifra back in 1993 (Aguenaou et al., 2019) as a result of a partnership between participants of the Catholic Relief Service (CRS) and the AMSED ("Association de Solidarité et de développement") (Benouna & Tkiouat, 2016). These actors were inspired by the Grameen Bank model founded during the 1970s by Mohammad Yunus in Bangladesh (Robinson, 2001).

Following 1993, more MFIs were created, and account for the establishment of Zakoura Foundation in 1995, FONDEP and Karama in 1996, Al Amana in 1997, and FBPMC ("Fondation Banque Populaire pour le Micro Crédit") in 1998 (Aguenaou et al., 2019; Benouna & Tkiouat, 2016). To

support these MFIs, the Moroccan government and UNDP (“United Nations Development Program”) launched the Micro-Start Program which aimed to enhance access to financial services by microentrepreneurs and low-income individuals (Benouna & Tkiouat, 2016). At this stage, MFIs were supported by various governmental and non-governmental agencies. This included USAID subsidies of 16 Million USD and the Hassan II funds of 100 Million MAD in 2000 (Aguenaou et al., 2019). Concerning the regulations governing MFIs in Morocco, they consist of a founding text established in 1999, which was amended in 2004 and 2012 (Law No. 18-97) (Shabbir, 2016). The intention behind this law is to regulate the microfinance sector by providing the possibility for associations to be transformed into credit institutions while expanding their services (Shabbir, 2016). Furthermore, these regulations set a loan ceiling of 50 000 MAD with the flexibility of adapting to several levels of amounts. However, interest rates are not regulated for MFIs until they hold credit institution status (Abdel Aziz et al., 2016).

Currently, Moroccan MFIs include 13 institutions (Aguenaou et al., 2019) with a share of 84% concentrated among the first three leading ones (Benouna & Tkiouat, 2016). These financial institutions had more than one million active borrowers in 2019, with the highest historical number of almost 1.2 million active borrowers in 2009. This accounts for a share of 64% for women borrowers, and a 3:1 urban-to-rural borrower ratio (Benouna & Tkiouat, 2016). Additionally, loan portfolios were multiplied by 11, and clients’ outstanding were multiplied by four between 2003 and 2007. But for the outstanding loans, they noticed a small decline starting in 2009, which rebounded by the end of 2014 to reach a total of 5.9 million MAD in 2015 (Benouna & Tkiouat, 2016). The distribution of Moroccan MFIs is balanced around all regions of the country. The highest concentration is in Grand Casablanca, Marrakesh-Tensifet-AlHouz, and Souss Massa Draa with a market share of 10.01%, 9.62%, and 9.43%, respectively (Benouna & Tkiouat, 2016). But for the lowest concentration of MFIs in Morocco, they account for the regions of Oued Dahab – Lagouira, Laayoun-Boujdour, and Guelmim-Essmara with a market share of 0.54%, 0.93%, and 2.86%, respectively (Benouna & Tkiouat, 2016). For the ten remaining regions, MFIs’ concentration ranges between the market share rates of 4.16% and 9.26% (Benouna & Tkiouat, 2016). The loan portfolios of Moroccan MFIs are allocated in various sectors that are mainly trade, handicrafts, crafts, agriculture, and breeding services with percentages of 43%, 22%, 17%, 11%, and 7%, respectively (Benouna & Tkiouat, 2016; Morvant-Roux et al., 2014; Mourji, 2000; Reille, 2009). The geographical and across-sector distribution of MFIs aligns with their social mission which aims at reducing poverty in addition to increasing access to capital for microentrepreneurs and low-income individuals in the Kingdom of Morocco. To note, efforts do not only relate to providing loans as MFIs are also focused on assisting their clients in their businesses (e.g., developing a business plan).

While previous contributions linked to MFIs in the Moroccan context assess the impact of loans on households and micro-entrepreneurs, the evolution of MFIs, and the impact of MFIs on economic variables, very few focused on assessing the determinant of their profitability and sustainability (Aguenaou et al., 2019, 2021). This is mainly because financial performance and social outreach are perceived as contradicting each other in the microfinance sector.

The following paper investigates the impact of the different loan portfolio characteristics on Moroccan MFIs’ profitability and sustainability. Concerning profitability, it bears several meanings and can be measured through different dimensions (Aguenaou et al., 2019). Yet, this paper follows the classical context and studies MFIs’ profitability from a profit perspective. Thus, profitability is measured using two financial ratios that are return on assets (ROA) and return on equity (ROE). With regards to sustainability, and in the context of this research, it is directly linked to profit. This is because higher levels of profit imply increasing MFIs’ independence by plowing back their retained earnings.

Within the Moroccan context, very few contributions focused on investigating the link between loan portfolio characteristics and the independent variables cited before. For this, the goal of

this paper is to respond to the following research question: How do loan portfolio size, type, return, risk, management effectiveness, write-offs, and recoveries variables impact Moroccan MFIs' profitability and sustainability? This is to suggest strategies to existing Moroccan MFIs to enhance their profitability and sustainability while simultaneously considering their social mission.

The following contribution is organized as follows. Section 2 presents the literature review. Section 3 presents the data, variables, assumptions, methods, and models to be investigated. Section 4 presents the results obtained. Section 5 discusses the results and provides policy recommendations. Finally, section 6 concludes the paper and suggests avenues for future research.

## 2. Literature Review

### 2.1 Context of the Study

Microfinance institutions' profitability and sustainability have been the subject of interest of policy-makers and academics in the most recent decades (e.g., Aguenau et al., 2019, 2021; Chikalipah, 2017; Hemtanon Gan, 2022; Kinde, 2012; Ramírez Rocha et al., 2019). The primary goal of MFIs globally is to provide access to financial resources to poor communities to alleviate poverty (Hakizimana Muathe, 2022). This is by providing the necessary funds to boost the economic activity of low-income individuals (Almas Mukhtar, 2014; Hassan, 2022). Microfinance is affiliated with programs that support individuals with significant subsistence problems in developing countries without the use of traditional collateral or guarantees (Hamada, 2010). Still, this sector has demonstrated that low-income individuals are viable customers when approached the right way, which requires the mitigation of adverse selection, moral hazard, and other agency problems (Dokulilová et al., 2009).

The challenge remains in meeting the mission of these institutions while simultaneously increasing their corresponding outreach, sustainability as well as profitability (Cull et al., 2009). MFIs face the microfinance schism, which includes social and financial performances (Kipesha Zhang, 2013). Concerning the social performance of MFIs, it is carried by the welfarists and requires poverty alleviation. On the other hand, MFIs' financial performance is carried out by institutionalists and requires the profitability and viability of microfinance institutions (Ngumo et al., 2017). The current contribution is an extension of the work of Aguenau et al. (2019) and supports the institutionalist school of thought by setting up autonomous and sustainable financial intermediation for low-income individuals that are neglected or underserved by the traditional financial system.

According to Caserta et al. (2018), the focus on assessing MFIs' sustainability and profitability led these institutions to shift their mission towards focusing on relatively wealthier clients. This is explained by the dynamics of the average loan size provided by MFIs, which is driven by MFIs' profit-seeking behaviors (Armendariz De Aghion Gollier, 2000). In addition to that, the same authors indicate that this shift is occurring due to the lack of collateral among the poorer segment, which leads to loaning them using joint liability programs, which is not the case for relatively wealthier individuals. But for Cozarenco et al. (2022), the authors suggest that higher levels of donors' subsidized funds increase the risk of MFIs' mission drift, which leads them to become socially undesirable. While numerous contributions provide evidence related to MFIs' mission drift (Cozarenco et al., 2022; Cull et al., 2007, 2009; Hermes et al., 2011), other researchers show the opposite (Mohd et al., 2021). For instance, evidence from the contribution of Quayes (2012) shows that there is a positive correlation between social welfare and profitability at a cross-country level. Frank et al. (2008) analysis indicates that regulated MFIs provide larger loans compared to unregulated ones to support small entrepreneurs to widen their business activities. Finally, Mohd et al. (2021) found evidence that MFIs can ensure their social mission while simultaneously generating large amounts of profits.

In the MFIs' context, sustainability refers to the ability to cover operating expenses using operating revenues generated from their activities (Memon et al., 2020). Achieving sustainability within MFIs is important as it ensures their continuous operations even in the case when partners and donors are not able to provide funds (Henock, 2019; Kipesha Zhang, 2013). Moreover, CGAP (1998)

demonstrates that achieving high levels of sustainability leads to achieving profitability. Concerning profitability, is defined in the classical context from the profit perspective (Aguenaou et al., 2019). More specifically, it measures the financial profitability of MFIs captured from using their assets or invested capital (Aguenaou et al., 2019, 2021).

To analyze MFI's financial performance, different dependent variables were used and accounted for ROE and/or ROA (Abrar Javaid, 2016; Aguenau et al., 2019, 2021; Patil Gopal, 2015). Other contributions use different variables such as profit margin (Shkodra, 2019). To measure MFI's financial sustainability, the most used dependent variables are operating self-sufficiency (OSS) (Aguenaou et al., 2019, 2021), and/or financial self-sufficiency (FSS) (Abrar Javaid, 2016; Afrifa et al., 2019; Kar Swain, 2014; Masanyiwa et al., 2022; Rahman Mazlan, 2014). The range of explanatory variables that represent the different characteristics of a loan portfolio is presented in the next section.

## **2.2 Impact of Loan Portfolio Characteristics on MFIs' Profitability and Sustainability**

Relationships between MFIs' sustainability and profitability with their corresponding loan portfolio characteristics have been analyzed by numerous scholars (Afrifa et al., 2019; Rahman Mazlan, 2014). Concerning the impact of the size of the loan portfolio on MFIs' profitability, Afrifa et al. (2019) assessed the amount in terms of the monetary value of the outstanding loan on MFI's ROA and OSS. This analysis includes 625 MFIs in 40 different countries between 2010 and 2015. Findings indicate that this variable has a significant impact on both ROA and OSS. For Abdulai and Tewari (2017), the authors include the gross loan portfolio, the number of active borrowers, and the average loan size as proxy measures for the size of loan portfolios. This paper covers 71 MFIs in 10 countries for the period between 2003 and 2013. In this study, empirical findings indicate that the gross loan portfolio and average loan size both significantly impact OSS and have no impact on ROA, while the number of active borrowers has no impact on the dependent variables.

Kar and Swain (2014) assessed the impact of the loan-to-asset ratio on financial profitability and sustainability for 379 MFIs in 71 countries. Results indicate that this variable has a positive significant relationship with FSS, ROA, and self-sufficiency index (SSI), which is total revenues divided by the sum of total revenues and total expenses. Rahman and Mazlan (2014) investigated the impact of the number of active borrowers of 5 MFIs in Bangladesh on FSS for the period between 2005 and 2011. Findings indicate that this independent variable has a significant positive impact on FSS. Mahapatra and Dutta (2016), the authors assessed the impact of the number of active borrowers, gross loan portfolio, and average loan balance on the OSS for 65 MFIs in India between 2005 and 2013. Results show that the number of active borrowers and the average loan balance per borrower variables have a significant positive impact on the OSS, which is also the case for the impact of the gross loan portfolio variable under a significance level of 10%.

In the contribution of Masanyiwa et al. (2022), the authors assessed the impact of the number of clients, the number of active borrowers, and the gross loan portfolio on MFIs' OSS and FSS in Zanzibar. Results indicate that the number of active borrowers has a positive impact on OSS while the gross loan portfolio has a negative impact on both OSS and FSS. In the MENA region, Abu Wadi et al. (2021) also assessed the impact of loan portfolio size on MFIs' profitability and sustainability using the data of 82 MFIs for the period between 2004 and 2018. Findings show that the number of active borrowers has a negative impact on ROA, and MFIs' total assets have a positive impact on ROA.

In the existing literature, little attention has been given to assessing the link between the type of loan portfolio on MFIs' profitability and sustainability. In the contribution of Kar and Swain (2014), the authors assessed the impact of loan delivery methods (e.g., solidarity groups and village banks) on FSS, OSS, and SSI in a cross-country analysis that covers 379 MFIs in 71 countries between 2003 and 2008. With regards to the solidarity group loan delivery method, results indicate that there is no relationship with the dependent variables. But for the village bank loan delivery method,

results show that under a 10% significant level, this variable has a significant negative impact on ROA and FSS. Yet, no relationship is found between the village bank delivery method variable and the SSI. Similarly, the literature related to the impact of write-offs and recoveries on the profitability and sustainability of MFIs is also limited in terms of the number of contributions. To the authors' knowledge, only the contribution of Masanyiwa et al. (2022) used the loan repayment rate as a proxy for write-offs. In this contribution, findings did not find evidence related to the impact of this variable on OSS and FSS in the case of Zanzibar.

Concerning the impact of loan portfolio risk on MFIs' financial performance and sustainability, gained massive interest in the existing literature (Abu Wadi et al., 2021). In the contribution of Parvin et al. (2020), the authors assessed the impact of the loan loss provision amount to total outstanding loans on ROA and net income to expenditure ratio (NIER) for 187 MFIs in Bangladesh between 2005 and 2014. Results indicate that the risk variable has a significant negative relationship with both sustainability (NIER) and profitability (ROA).

Afrifa et al. (2019), Abdulai, Tewari (2017), and Abu Wadi et al. (2021) both assessed the impact of the portfolio at risk 30 (PAR30) variable on ROA and OSS. For the first contribution, findings indicate that the PAR 30 variable has a significant negative relationship with both ROA and OSS under a significance level of 1% using panel data of 625 MFIs in 40 different countries between 2010 and 2015 (Afrifa et al., 2019). The same findings are found for the relationship between PAR 90 with ROA and OSS (Abrar & Javaid, 2016). However, no significant relationship is found between PAR 90 and return on equity (ROE). But for Abdulai and Tewari (2017), the PAR 30 variable has a significant negative impact only on OSS and has no impact on the ROA. Concerning the paper of Abu Wadi et al. (2021), the authors found that PAR30 has a negative impact on ROA, ROE, and OSS of MFIs in the MENA region.

Chikalipah (2017) also analyzed the impact of PAR 30 with ROA for 291 MFIs in 34 countries between 2006 and 2014. Findings indicate that the PAR 30 variable has a significant negative impact on ROA for low-income and lower-medium-income countries, and no significant relationship is found between these variables for upper-medium-income countries. For the relationship between PAR 30 and OSS in the case of Indian MFIs, a significant negative relationship is found (Mahapatra Dutta, 2016).

For the return characteristic of MFIs loan portfolios, Shkodra (2019) assessed its impact on both financial performance and sustainability in the case of Kosovo. The analysis consists of data collected from financial reports published by the Microfinance Institution or the Central Bank of Kosovo (CBK) between 2007 and 2016. Findings indicate that the nominal yield has a significant positive impact on ROA and profit margin (PM) and no impact on the OSS. Additionally, Masanyiwa et al. (2022) found evidence that loan interest rates positively contribute to the FSS in Zanzibar.

In the case of Bangladesh, findings indicate that the yield on the gross loan portfolio has a significant relationship with financial sustainability (Rahman & Mazlan, 2014). Kar and Swain (2014), the authors analyzed the relationship between the real yield of each loan delivery method (total, village, and solidarity) on MFIs' self-sufficiency, ROA, and SSI for 379 MFIs in 71 different countries between 2003 and 2008. Findings indicate that the real yield on the gross portfolio has a positive significant impact on all dependent variables. For other return variables, and under the model that includes non-linear effects, analyses indicate that the real yield of the solidarity delivery method has a significant positive impact on the ROA while the real yield of the village group delivery method has a significant negative relationship with all dependent variables (Kar & Swain, 2014). The analysis of 65 MFIs in India related to the yield on the gross portfolio variable indicates that this variable only impacts the OSS with a significant positive coefficient and has no impact on the ROA (Abdulai & Tewari, 2017). This aligns with the findings of the contribution of Mahapatra, Dutta (2016), Remer, and Kattilakoski (2021).

Regarding the management effectiveness variables, Rahman and Mazlan (2014) indicate that

the cost per borrower variable has no significant relationship with the FSS. The same contribution indicates that the operating expense ratio and personnel productivity demonstrate a significant relationship with the dependent variable. Mahapatra and Dutta (2016) analyzed the impact of cost per borrower and personnel productivity in the case of Indian MFIs. Results show that the cost per borrower has a significant impact on OSS, which is the opposite of personnel productivity. In the paper of Abdulai and Tewari (2017), the operating expense to asset ratio is proved to have a significant negative impact on the OSS with no impact on the ROA in the case of the 71 MFIs included in the study. However, Kar and Swain (2014) indicate that among all management effectiveness variables, the operating expenses to assets ratio is the only variable that shows a significant negative relationship with FSS, ROA, and SSI. Finally, Remer and Kattilakoski (2021) analyzed the impact of management effectiveness on the OSS of 416 Sub-Saharan African MFIs. While the cost per borrower has no impact on the OSS, the total expense to total assets ratio has a significant negative impact on the self-sustainability of MFIs included in the study.

The following table summarizes the most important proxy variables used in the literature to represent the independent variables. Additionally, Table 1 will also highlight the expected relationship between the independent variables and the dependent ones.

**Table 1: Summary of proxy variables representing portfolio characteristics and expected relationships between dependent and independent variables**

Loan portfolio characteristic	Proxy variables in the literature	Expected impact on profitability	Expected impact on sustainability	References
<b>Size</b>	Gross outstanding loan portfolio, number of active borrowers, average loan size, and loan-to-asset ratio.	Positive	Positive	Aguenaou et al. (2019), Abdulai & Tewari (2017), Chikalipah (2017), Kar & Swain (2014), Mahapatra & Dutta (2016), Afrifa et al. (2019), El Khatri (2014), Parvin et al. (2020), Remer and Kattilakoski (2021), Rahman and Mazlan (2014), Masanyiwa et al. (2022), Abu Wadi et al. (2021), Masanyiwa et al. (2022), Abu Wadi et al. (2021), etc.
<b>Type</b>	Solidarity groups, and village banks.	Mixed	Mixed	
<b>Risk</b>	Loan loss provision, portfolio at risk (PAR 30 and PAR 90), and risk coverage.	Negative	Negative	
<b>Return</b>	Nominal yield on the gross loan portfolio, real yield on the gross loan portfolio, and interest income on the loan portfolio.	Positive	Positive	
<b>Management effectiveness</b>	Cost per borrower, personnel productivity, operating expenses to assets ratio, loan per staff member, loan per loan officers, and others.	Mixed	Mixed	
<b>Write-offs and recoveries</b>	Write-offs, and recoveries on loans written off.	Mixed	Mixed	

### 2.3 Profitability and Sustainability of MFIs in The Moroccan Context

In the Moroccan context, little attention to MFIs' performance is given in the literature. El Kharti (2014) assessed the impact of interest rates and equity, quality of loan portfolio, and staff productivity on Moroccan MFIs' ROA and ROE for the period between 2003 and 2010. Results indicate that the PAR30 negatively impacts both independent variables, the percentage of female borrowers, and the number of loans significantly impact the ROA, and the number of active borrowers significantly impacts the ROA. No further significant relationships are found. In the contribution of Aguenaou et al. (2019), the authors assessed the impact of PAR, size of MFIs, outreach, and personnel productivity variables on MFIs' ROA, ROE, and OSS. Using fixed effect models, findings indicate that the number of loans per staff member significantly and positively impacts ROA and OSS, PAR negatively impacts

the dependent variables on a 10% significance level, the number of active borrowers negatively impacts ROE, and the gross loan portfolio positively impacts ROE. In the most recent work of Aguenau et al. (2021), the authors investigated the impact of personnel productivity, portfolio quality, and regulatory environment on the financial sustainability and profitability of Moroccan MFIs. The contribution found a positive association between personnel productivity variables and the independent variables. However, the results didn't find enough evidence of the impact of the regulatory environment on the profitability and sustainability of Moroccan MFIs (Aguenaou et al., 2021).

To the authors' knowledge, there are only three publications that investigate the determinants of Moroccan MFIs' profitability and sustainability (Aguenaou et al., 2019, 2021; el Kharti, 2014). Additionally, the contribution of Abu Wadi et al. (2021) includes Morocco in their analysis of MFIs' sustainability as part of the MENA region. The following contribution is an extension of the work of Aguenau et al. (2019, 2021). More specifically, the current contribution proposes a new theoretical framework to assess the impact of Moroccan MFIs' loan portfolio characteristics on their corresponding profitability and sustainability.

### 3. Data and Methodology

The following contribution assesses the financial performance and sustainability of Moroccan MFIs in relation to loan portfolio characteristics that account for MFI's portfolio size, portfolio type, portfolio risk, portfolio return, portfolio management effectiveness, and portfolio write-offs as well as recoveries. The data used is withdrawn from the Microfinance Information Exchange (MIX) market database and includes six Moroccan MFIs namely (Al Amana, Al Karama, Attadamoune, ATTAWFIQ, Fondation Albaraka, and INMAA) over the period between 2003 and 2018. These institutions are a representative sample of 50% of the total MFIs in Morocco. Concerning the remaining MFIs, they have been excluded from the study due to the lack of observations (Table 2).

To assess the different relationships between the dependent and independent variables of the models described below, panel regression models (Pooled, Fixed effect, and Random effect) will be used. To note, panel regression analysis is a powerful statistical method to control dependencies of independent variables on the dependent ones and enables identifying the significance of the impact between two or more variables. This method is widely used and has been massively used in the microfinance literature (e.g., Abdulai & Tewari (2017) and Afrifa et al. (2019)).

Table 2: MFI Data Summary

MFI Name	Included or not included in the study	Minimum number of observations per variable	Maximum number of observations per variable	Period
Al Amana	Included	7	20	1999-2018
Al Karama	Included	6	17	2003-2018
AMOS	Not included	3	10	2002-2012
ARDI	Not included	1	8	2003-2010
Attadamoune	Included	7	18	2000-2018
ATTAWFIQ MICRO-FINANCE	Included	7	15	2003-2016
Fondation Albaraka	Included	5	16	2001-2017
INMAA	Included	8	15	2003-2017
Zakoura	Not included	1	12	2000-2010

Source: MIX Market dataset

### 3.1 Dependent Variables

The dependent variables in this study, which are also extracted from the MIX market database, represent MFIs' financial profitability and financial sustainability. Concerning profitability, it is represented by ROA and ROE which are widely used in the existing literature (Aguenau et al., 2019; el Kharti, 2014). ROA is a valid proxy for profitability and includes the efficiency of MFIs in using their assets (el Kharti, 2014; Hartarska, 2005). ROE measures the profitability of MFIs in relation to their corresponding donating organizations, subsidiaries, and grant providers (Aguenau et al., 2019). According to El Khatri (2014), ROA and ROE are complementary ratios that enable building a clear understanding of Moroccan MFIs, given that they rely heavily on external funding and subsidiaries. With regards to financial sustainability, it refers to MFIs' ability to cover their expenses while simultaneously expanding. This is through being able to increase MFIs' independency from grants and donations by generating their funds, and /or through the reinvestment of profit (Bassem, 2009; Hartarska, 2005). Financial sustainability is represented by OSS, as this variable is commonly used in the literature to measure efficiency. Also, this variable enables measuring and capturing the balance between operating costs (excluding financial costs) and operating revenues of MFIs (Khan et al., 2017).

### 3.2 Independent Variables

The current paper divides MFIs' loan characteristics into six main categories that account for the size, type, risk, return, management effectiveness, and write-offs as well as recoveries. For this, the independent variables will be proxied by variables borrowed from existing literature and will be grouped based on each sub-characteristic cited above as illustrated in the conceptual framework (Figure 1). The independent variables will be explained in subsequent sections (section 3.2.1 to section 3.2.6).

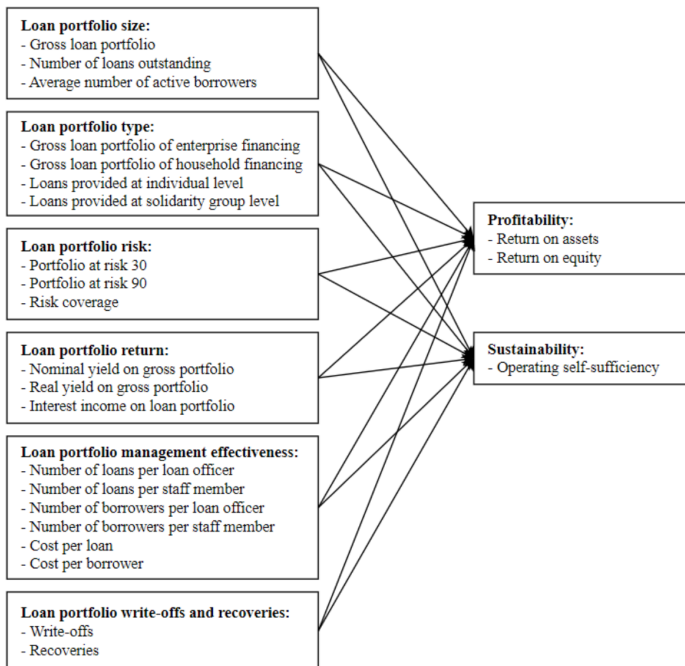


Figure 1: Conceptual framework



### 3.2.1 Loan Portfolio Size Variables

The current contribution assesses the impact of loan portfolio size on Moroccan MFIs' financial performance and sustainability. This loan portfolio characteristic is measured using three proxy variables that are: gross loan portfolio (GLP), number of loans outstanding (NLO), and average number of active borrowers (ANAB) (Gutiérrez-Goiria & Goitisoló, 2011). In the context of this study, GLP includes all outstanding principal for all borrowers and excludes write-offs, interest receivable, and employee loans (Gutiérrez-Goiria & Goitisoló, 2011). The significance of the relationship between these variables and the dependent ones will be analyzed using the following models:

**Model A.1:** ROA as the dependent variable

$$ROA = C + \beta_1(GLP) + \beta_2(NLO) + \beta_3(ANAB) + \epsilon$$

**Model A.2:** ROE as the dependent variable

$$ROE = C + \beta_1(GLP) + \beta_2(NLO) + \beta_3(ANAB) + \epsilon$$

**Model A.3:** OSS as the dependent variable

$$OSS = C + \beta_1(GLP) + \beta_2(NLO) + \beta_3(ANAB) + \epsilon$$

### 3.2.2 Loan Portfolio Type Variables

sustainability, four variables are used as a proxy. These variables include the gross loan portfolio of both the offered credit products to enterprise financing and to household financing – GLPEF and GLPHF (Blanco-Oliver & Irimia-Diéguez, 2019). In addition to that, the two remaining loan type variables account for the number of loans provided at individual levels (INDIVIDUAL) or solidarity group levels (SOLIDARITY).

The relationship between these independent variables and the dependent ones will be analyzed using the following models:

**Model B.1:** ROA as the dependent variable

$$ROA = C + \beta_1(GLPEF) + \beta_2(GLPHF) + \beta_3(INDIVIDUAL) + \beta_4(SOLIDARITY) + \epsilon$$

**Model B.2:** ROE as the dependent variable

$$ROE = C + \beta_1(GLPEF) + \beta_2(GLPHF) + \beta_3(INDIVIDUAL) + \beta_4(SOLIDARITY) + \epsilon$$

**Model B.3:** OSS as the dependent variable

$$OSS = C + \beta_1(GLPEF) + \beta_2(GLPHF) + \beta_3(INDIVIDUAL) + \beta_4(SOLIDARITY) + \epsilon$$

### 3.2.3 Loan Portfolio Risk Variables

The third characteristic of a loan portfolio is risk. The first variable used to measure risk is similar to the one used in the contributions of El Kharti (2014) and Aguenau et al. (2019). The portfolio at risk variable represents the part of the portfolio that was impacted by the borrowers' default as a percentage of the total gross portfolio value (Aguenaou et al., 2019), and is calculated by dividing the portfolio overdue plus the renegotiated portfolio by the gross loan portfolio. However, the current analysis distinguishes between PAR 30 and PAR 90, where PAR 30 relates to the principal outstanding overdue for 30 days and PAR 90 relates to the principal overdue for 90 days. Finally, the last variable used to measure risk is risk coverage (RC), which is calculated by dividing the impairment loss allowance by PAR30 (Fersi & Boujellbé, 2016).

To assess the impact of the risk variables on ROA, ROE, and OSS, the following models will be used:

**Model C.1:** ROA as the dependent variable

$$ROA = C + \beta_1(PAR30) + \beta_2(PAR90) + \beta_3(RC) + \epsilon$$

**Model C.2:** ROE as the dependent variable

$$ROE = C + \beta_1(PAR30) + \beta_2(PAR90) + \beta_3(RC) + \epsilon$$

**Model C.3:** OSS as the dependent variable

$$OSS = C + \beta_1(PAR30) + \beta_2(PAR90) + \beta_3(RC) + \epsilon$$

### 3.2.4 Loan Portfolio Return Variables

The loan portfolio return characteristics represent the interest rates charged by MFIs to their borrowers. These variables also measure the profit or loss derived from the issued loans by MFIs. In the context of this study, return variables are represented by the nominal yield on the gross portfolio (YGN), the real yield on the gross portfolio (YGR), and interest income on the loan portfolio (IILP).

Concerning YGN, it is defined as the adjusted financial revenue, which is derived from the loan portfolio, divided by the average gross loan portfolio (Abdur Rahman & Mazlan, 2014). For YGR, it is similar to YGN, except that it accounts for inflation. Finally, IILP is defined as the interest generated by the loan portfolio. This latter interest income excludes expenses that reduce accrued interest in the case of uncertainty of collecting it. IILP is widely used in the conventional banks' literature as a measure of profitability (Gounder & Sharma, 2012; Lee et al., 2010; Mileris, 2015).

The corresponding OLS models that will enable analyzing the significant relationships between return variables and the dependent variables are given such as:

**Model D.1:** ROA as the dependent variable

$$ROA = C + \beta_1(YGN) + \beta_2(YGR) + \beta_3(IILP) + \epsilon$$

**Model D.2:** ROE as the dependent variable

$$ROE = C + \beta_1(YGN) + \beta_2(YGR) + \beta_3(IILP) + \epsilon$$

**Model D.3:** OSS as the dependent variable

$$OSS = C + \beta_1(YGN) + \beta_2(YGR) + \beta_3(IILP) + \epsilon$$

### 3.2.5 Loan Portfolio Management Effectiveness Variables

The loan portfolio management effectiveness characteristic includes variables that account for staff and personnel productivity (Kinde, 2012) as well as loan costs. For personnel productivity, the efficiency of MFIs' loan officers and staff members in relation to loan portfolios is measured through a series of ratios (Aguenau et al., 2019). The variables that represent staff productivity are the number of loans per loan officer (LPLO), the number of loans per staff member (LPSM), the number of borrowers per loan officer (BPLO) (Aguenau et al., 2019; Patil & Gopal, 2015), and the number of borrowers per staff member (BPSM). For the variables that measure MFIs' costs in relation to MFIs' loan portfolios, this study uses the cost per borrower (CPB) and cost per loan (CPL) variables (Pal & Mitra, 2017).

In order to assess the impact of loan portfolio management effectiveness variables on ROA, ROE, and OSS, the following models will be used:

**Model E.1:** ROA as the dependent variable

$$ROA = C + \beta_1(LPLO) + \beta_2(LPSM) + \beta_3(CPB) + \beta_4(CPL) + \beta_5(BPLO) + \beta_6(BPSM) + \epsilon$$

**Model E.2:** ROE as the dependent variable

$$ROE = C + \beta_1(LPLO) + \beta_2(LPSM) + \beta_3(CPB) + \beta_4(CPL) + \beta_5(BPLO) + \beta_6(BPSM) + \epsilon$$

**Model E.3:** OSS as the dependent variable

$$OSS = C + \beta_1LPLO + \beta_2(LPSM) + \beta_3(CPB) + \beta_4(CPL) + \beta_5(BPLO) + \beta_6(BPSM) + \epsilon$$

### 3.2.6 Loan Portfolio Write-Offs and Recoveries

The final loan portfolio characteristic accounts for both write-offs (WO) and recoveries (RLWO). Write-offs represent the value of loans that are removed from the MFIs' gross loan balance because they are highly unlikely to be repaid in the future (D'Espallier et al., 2011). But for recoveries on loans written off, they represent the value of principal recovered from loans that have already been written off. The corresponding OLS models analyze the significant relationship between write-offs and recoveries and the dependent variables:

**Model F.1:** ROA as the dependent variable

$$ROA = C + \beta_1(WO) + \beta_2(RLWO) + \epsilon$$

**Model F.2:** ROE as the dependent variable

$$ROE = C + \beta_1(WO) + \beta_2(RLWO) + \epsilon$$

**Model F.3:** OSS as the dependent variable

$$OSS = C + \beta_1WO + \beta_2(RLWO) + \epsilon$$

## 4. Results

The panel data analysis initially consists of conducting the Hausman test, which resulted in determining the type of panel regression to be adopted. In the case of this research, fixed-effect models and random-effect models were adopted based on the test results of each model. Table 3 shows the Hausman test results for each model used in this contribution, and results indicate that models A.1, B.1, B.2, B.3, C.1, C.2, C.3, D.1, D.3, F.1, F.2, and F.3 all use random effect panel regression models. However, the remaining models use fixed effect models.

The panel data has been adjusted as a result of other diagnostic tests such as assessing heteroscedasticity, multicollinearity, and normality. This is to align with the assumptions of the panel regression analysis. With regards to the multicollinearity issues, they have been addressed by removing several variables, while heteroscedasticity issues have been addressed by transforming some models with the log function. In addition to that, some Moroccan MFIs were excluded from some models due to the lack of observations in some variables. The remaining of this section will provide the results for each of the models discussed in the previous section.

**Model A** – Impact of size variables on ROA (F-test = 7.04 < 0.05), ROE (F-test = 7.95 < 0.05), and OSS (F-test = 10.46 < 0.05)

According to Table 4, NLO positively and significantly impacts all the dependent variables. This indicates that any unit increase in the number of loans outstanding increases ROA, ROE, and OSS with the coefficients of 0.00012, 0.001, and 0.0005, respectively. However, the ANAB variable impacts significantly and negatively all the dependent variables under a significance level of 1%. Finally, GLP shows no significant impact on ROA and OSS, but positively and significantly impacts ROE under a 1% significance level.

**Model B** – Impact of type variables on ROA (F-test = 5.32 < 0.05), ROE (F-test = 4.17 < 0.05), and OSS (F-test = 4.20 < 0.05)

Table 3: Hausman test results for models A.1 to model F.3

Model	Chi-Sq. Statistic	P-value	Decision
Model A.1	4.83	0.18	Random effect
Model A.2	12.81	0.01	Fixed effect
Model A.3	28.35	0.00	Fixed effect
Model B.1	2.98	0.56	Random effect
Model B.2	8.34	0.08	Random effect
Model B.3	6.53	0.16	Random effect
Model C.1	1.21	0.75	Random effect
Model C.2	2.52	0.47	Random effect
Model C.3	4.88	0.18	Random effect
Model D.1	0.60	0.90	Random effect
Model D.2	10.27	0.02	Fixed effect
Model D.3	3.26	0.35	Random effect
Model E.1	27.03	0.00	Fixed effect
Model E.2	15.22	0.02	Fixed effect
Model E.3	63.81	0.00	Fixed effect
Model F.1	2.95	0.23	Random effect
Model F.2	2.79	0.25	Random effect
Model F.3	4.79	0.09	Random effect

Findings indicate that the GLPHF does not impact ROA, while the GLPEF positively impacts ROA, as it resulted in a t-statistic value of 3.59 which corresponds to a low p-value of 0.001. For both loans that are allocated on an individual basis and solidarity basis, any increase in these variables leads to a decrease in the ROA (Table 5).

Table 4: Panel regression analysis for Model A

Variable	Models		
	ROA	ROE	OSS
Constant	3.653585 *** (2.66)	35.06688 *** (3.85)	127.6011 *** (24.98)
GLP	1.27E-08 (0.56)	1.11E-06 *** (4.92)	-9.11E-08 (-0.71)
NLO	0.000116 *** (5.40)	0.001039 *** (6.44)	0.000519 *** (5.63)
ANAB	-0.000137 *** (-4.61)	-0.002050 *** (-7.58)	-0.000577 *** (-3.73)

\*\*\* significant under 1%, \*\* significant under 5%, and \* significant under 10%

The impact of the gross loan portfolio on enterprise finance and household finance has a similar impact on ROE compared to the impact on ROA. However, the impact of the solidarity methodology on ROE resulted in a t-statistic value of -1.97 which corresponds to a p-value of 0.059. This means that under a significant level of 5%, this variable has no significant impact. But considering a significant level of 10%, a unit increase of this variable leads to a decrease in ROE (Table 5). Concerning

Table 5: Panel regression analysis for Model B

Variable	Models		
	ROA	ROE	OSS
Constant	-3.488386 ** (-2.77)	-2.810117 *** (-2.53)	1.716247 *** (18.50)
GLPEF	2.291891 *** (3.59)	1.711883 *** (3.05)	0.091338 ** (2.07)
GLPHF	-0.093850 (-0.54)	-0.038327 (-0.25)	-0.004347 (-0.31)
INDIVIDUAL	-1.300945 ** (-2.64)	-0.896560 ** (-2.07)	-0.043840 (-1.19)
SOLIDARITY	-0.500844 *** (-2.38)	-0.365216 * (-1.97)	-0.002608 (-0.22)

\*\*\* significant under 1%, \*\* significant under 5%, and \* significant under 10%

the relationship between loan portfolio type variables and OSS, results show that no significant relationships are found, except for the gross loan portfolio enterprise finance. This former variable is found to have a positively related relationship with the OSS with a statistically significant coefficient of 0.09 (Table 5).

**Model C** – Impact of risk variables on ROA (F-test = 30.79 < 0.05), ROE (F-test = 99.26 < 0.05), and OSS (F-test = 22.48 < 0.05)

Table 6: Panel regression analysis for Model C

Variable	Models		
	ROA	ROE	OSS
Constant	6.555727 *** (5.24)	29.52802 *** (4.94)	131.2739 *** (26.16)
PAR30	-2.678575 *** (-6.90)	-35.37918 *** (-16.18)	-10.06304 *** (-5.40)
PAR90	2.313170 *** (4.24)	39.89658 *** (13.03)	7.939907 *** (3.04)
RC	0.002778 (1.18)	0.003785 (0.28)	0.023441 ** (2.05)

\*\*\* significant under 1%, \*\* significant under 5%, and \* significant under 10%

For the impact of risk variables on ROA, no significant relationship is found with the risk coverage variable. Concerning the PAR30 variable, it has a significant negative relationship with the ROA with a coefficient of -2.68. But for PAR 90, results show that they positively impact ROA (Table 6).

Concerning the impact of risk variables on ROE, it is like the impact of the same variables on the ROA. This is because the resulted t-statistics for PAR30 and PAR90 have the values of -16.18 and 13.03 which correspond to p-values lower than 5% while the t-statistic value of the risk coverage variable is 0.28 which corresponds to a p-value of 0.78 (Table 6).

Concerning the impact of the risk variables on Moroccan MFIs' OSS, empirical results indicate that the PAR30 has a significant negative impact. Yet, any unit increase of PAR90 and RC variables leads

to a significant increase in OSS with their corresponding coefficients of 7.94 and 0.02, respectively (Table 6).

**Model D** – Impact of return variables on ROA (F-test =  $6.01 < 0.05$ ), ROE (F-test =  $2.08 < 0.05$ ), and OSS (F-test =  $5.93 < 0.05$ )

Table 7: Panel regression analysis for Model D

<i>Variable</i>	<i>Models</i>		
	<i>ROA</i>	<i>ROE</i>	<i>OSS</i>
Constant	3.137286 ** (2.30)	0.392483 (0.07)	117.7905 *** (21.72)
YGN	0.002501 (1.32)	0.003265 (0.20)	0.018130 ** (2.15)
YGR	0.000346 (0.15)	0.001822 (0.09)	-4.79E-05 (-0.00)
IILP	-0.009402 *** (-3.95)	0.069665 *** (3.36)	-0.039971 *** (-3.76)

\*\*\* significant under 1%, \*\* significant under 5%, and \* significant under 10%

IILP is the only variable among the return variable that has a significant relationship with ROA. This is because this variable resulted in a negative coefficient with a value of -0.01 and a t-statistic value of -3.95 which corresponds to a significant p-value of 0.0002 (Table 7).

For the impact of return variables on ROE, both YGN, and YGR do not show a significant relationship. But for IILP, and unlike its impact on ROA, findings show that it positively impacts ROE (Table 7).

Concerning the impact of return variables on OSS, results show that only YGN and IILP have a significant relationship with the dependent variable. The YGN positively impacts OSS with a coefficient of 0.02 while the IILP negatively impacts OSS with a coefficient of -3.76 (Table 7).

**Model E** – Impact of management effectiveness variables on ROA (F-test =  $13.06 < 0.05$ ), ROE (F-test =  $2.18 < 0.05$ ), and OSS (F-test =  $17.84 < 0.05$ )

Regarding the management effectiveness variables, results indicate that a unit increase in LPLO leads to a significant decrease in ROA. This is the opposite in the case of the relationship between BPLO and ROA. These two independent variables are both significant under a level of significance of 5%. But for LPSM and BPSM, they also demonstrate a positive and negative significant relationship, respectively, under a significant level of 10%. Finally, the CPB and CPL variables have no significant impact on the ROA (Table 8).

Concerning the impact of the management effectiveness variables on ROE, no significant relationships are found under a significance level of 5%. But under a 10% significant level, the LPSM and BPSM have a positive impact and a negative impact on ROE, respectively (Table 8). The impact of the management effectiveness on Moroccan MFIs' OSS indicates that both LPLO and BPSM have a significant negative impact, as they resulted in t-statistic values of -3.68 and -3.57 that correspond to significant p-values less than 5%. However, LPSM and BPLO both exhibit a statistically significant positive relationship with OSS, with coefficients of 11.57 and 8.69, respectively (Table\*).

**Model F** – Impact of write-offs and recoveries variables on ROA (F-test =  $10.04 < 0.05$ ), ROE (F-test =  $19.33 < 0.05$ ), and OSS (F-test =  $12.12 < 0.05$ )

Empirical findings indicate that WO negatively impacts ROA. This is because the resulting t-statistic accounts for a value of -3.42 which corresponds to a p-value of 0.001. For the REC, no significant relationship with the ROA is found (Table 9).

Table 8: Panel regression analysis for Model E

Variable	Models		
	ROA	ROE	OSS
Constant	-15.79025 *** (-4.10)	-149.0799 *** (-3.17)	41.35104 ** (2.58)
LPLO	-1.119598 ** (-1.99)	-11.02846 (-1.61)	-8.576045 *** (-3.67)
LPSM	1.491789 * (1.97)	16.25144 * (1.76)	11.57483 *** (3.67)
CPB	-0.356825 (-0.96)	-6.542299 (-1.44)	-0.916393 (-0.59)
CPL	0.391053 (1.04)	7.303579 (1.59)	1.007765 (0.64)
BPLO	1.141560 ** (2.02)	10.98847 (1.59)	8.685123 *** (3.70)
BPSM	-1.418766 * (-1.86)	-15.63005 * (-1.68)	-11.27904 *** (-3.57)

\*\*\* significant under 1%, \*\* significant under 5%, and \* significant under 10%

Like the impact of WO on ROA, they also have a significant negative relationship with ROE. But concerning REC, results show that they positively impact ROE (Table 9).

Finally, concerning the impact of WO on OSS, results indicate that they have a significant negative impact. However, no relationship was found between REC and OSS (Table 9).

Table 9: Panel regression analysis for Model F

Variable	Models		
	ROA	ROE	OSS
Constant	4.249631 *** (3.29)	11.05339 ** (2.14)	124.5536 *** (19.68)
WO	-5.03E-07 *** (-3.42)	-6.62E-06 *** (-6.20)	-1.94E-06 *** (-3.02)
REC	-3.12E-07 (-0.19)	4.14E-05 *** (3.55)	-9.24E-06 (-1.28)

\*\*\* significant under 1%, \*\* significant under 5%, and \* significant under 10%

## 5. Discussion and policy implications:

In this section, the study's findings on the profitability and sustainability of Moroccan microfinance institutions (MFIs) are presented, along with policy implications for these institutions. The results indicate that the number of outstanding loans has a positive impact on both profitability and sustainability for Moroccan MFIs. However, the average number of active borrowers was found to have a negative impact on profitability, which contradicts the findings of some previous studies such as Masanyiwa et al. (2022) and Abdulai, Tewari (2017). This negative impact may be due to poor credit assessment practices among Moroccan MFIs.

While there is no evidence to support a link between write-offs and the profitability and sustainability of MFIs in the existing literature, the study's findings show a significant negative association between the two variables in the Moroccan context. In addition, the study found that the quality of loan portfolios, as measured by PAR30, and the quality of loans at the individual and solidarity levels also have a negative impact on the profitability and sustainability of Moroccan MFIs, which is consistent with the findings of other studies such as Afrifa et al. (2019), Abdulai, Tewari (2017), Abu Wadi et al. (2021), and Chikalipah (2017). The study also found that various management variables, such as loans per loan officer and borrowers per staff member, have a negative impact on the profitability and sustainability of Moroccan MFIs. With regards to loans supporting microentrepreneurs, results found evidence that they positively impact the profitability and sustainability of Moroccan MFIs, however, interest income on loan portfolios exhibits a negative impact on these financial institutions, which contradicts the findings of Masanyiwa et al. (2022) and Shkodra (2019).

To this matter, enhancing the profitability and sustainability of Moroccan MFIs requires various strategies. First, MFIs should focus on their social mission and their outreach through expanding (e.g., to rural areas, new cities, and new geographical areas), collaborating with other organizations (e.g., NGOs), or using technology (e.g., mobile banking). This will enable Moroccan MFIs to increase their customer database and increase both the size of the gross loan portfolio and the number of loans outstanding. Second, Moroccan MFIs must focus on profitable loans such as the ones supporting microenterprises and microentrepreneurs. Third, Moroccan MFIs need to enhance the quality of the loan portfolio by implementing various strategies such as using a combination of qualitative and quantitative data to assess the creditworthiness of potential borrowers, developing standardized credit assessment tools, implementing credit scoring systems, or conducting regular loan portfolio reviews. By using these strategies, Moroccan MFIs will enhance their loan portfolio quality, which might lead to mitigating the negative effects of the portfolio at risk (PAR30) and the gross loan portfolio allocated for individuals and solidarity groups. Fourth, Moroccan MFIs need to better allocate their staff and employees to mitigate the adverse impact of some management effectiveness variables on the profitability and sustainability of these financial institutions. This can be supported by regular employee and staff training. Finally, it is essential for Moroccan MFIs to charge customers with appropriate interest rates. By lowering the current charged interest rates, Moroccan MFIs will be able to limit, if not exclude, the negative impact of the interest income on their profitability. Additionally, these institutions will also benefit from lowering the value of loans written-off, and thus, mitigate their impact on profitability and sustainability. Overall, these strategies can enable Moroccan MFIs to achieve their social mission while also ensuring a solid financial performance, benefiting both the institutions and their clients.

## 6. Conclusion

The following contribution aims at identifying the determinants of Moroccan MFIs' financial profitability and sustainability in relation to their corresponding loan portfolio characteristics. Using panel data for the years between 2003 and 2018, this contribution investigates how the size, type, risk, return, management effectiveness, write-offs, and recoveries of MFIs' loan portfolios influence their financial performance. Empirical findings provide a solid understanding of the main factors driving the continuous success of these financial institutions. Regarding the size of loan portfolios, there is evidence that supports the positive impact of the number of loans outstanding on the profitability and sustainability of Moroccan MFIs. This can be explained by the reliance of Moroccan MFIs on the fees charged to borrowers. However, the average number of active borrowers negatively impacts the dependent variables (e.g., ROA, ROE, and OSS), which might be explained by the low quality of MFIs' loan portfolios, or their poor credit assessment.

Findings also highlight the importance of loans allocated to support microenterprises and microentrepreneurs, as loans allocated for enterprise financing positively impact all dependent variables. But



for the loans allocated at individual and solidarity group levels, negatively impact MFIs' profitability, confirming the poor credit assessment of microloans in the Moroccan context.

Concerning the quality of loan portfolios, proxied by the value of loans that are past due by 30 days (e.g., PAR30), results support their negative impact on all dependent variables. This can be explained by the high default rate among Moroccan MFIs' customers, and the inefficiency of MFIs to recover their loan balance. This is further confirmed by the negative relationship between write-offs and MFIs' profitability and sustainability.

This contribution suggests various policy recommendations to Moroccan MFIs to enhance their financial profitability and sustainability, while simultaneously achieving their social mission. It is recommended for MFIs in the Moroccan context to: (a) increase their outreach by expanding, leveraging technology, or collaborating with external organizations; (b) allocate funds to profitable products (e.g., loans supporting microenterprises); (c) enhance the quality of loan portfolios by implementing various strategies (e.g., developing standardized credit assessment tools); (d) optimize staff and employee allocation; (e) revise the interest rate charged to customers. Implementing these strategies will help Moroccan MFIs improve their financial performance by reducing the negative impact of factors such as poor loan portfolio quality, misallocation of staff, and high default rates among customers. At the same time, these strategies will enhance their financial performance by focusing on positive factors such as increasing the number of outstanding loans.

Finally, it is important to cite the limitations of the current study. The first limitation concerns the used data. This contribution uses a representative sample of 50% of total MFIs in Morocco. Additionally, the data collected can be unbalanced for some models due to the lack of observations in some variables. Second, this study uses OLS panel analysis. While using this method enabled revealing important relationships involving various metrics related to financial performance and sustainability and their link to specific loan portfolio characteristics, more sophisticated statical approaches are likely to provide further findings. Third, this research focuses on investigating Moroccan MFIs only using firm-specific variables. These limitations suggest avenues for future research that includes, using other statistical techniques to identify the causal relationship among the variables, including other firm-specific variables in the models, and including other non-firm-specific variables (e.g., macroeconomic, and regulatory) in the models.

## Biography

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### **Conflicts of interest**

The authors declare no conflict of interest.

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