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Analysis of the determinants of credit risk in microfinance institutions in Morocco: A Panel Data Approach.

Analyse des déterminants du risque de crédit dans les institutions de microfinance au Maroc : Une approche par données de panel.

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Abstract

Microfinance plays a crucial role in Morocco's socio-economic development, but MFIs face specific risks, particularly credit risk, which can impact their performance.

This paper focuses on the analysis of the determinants of credit risk within microfinance institutions in Morocco, over a period from 2012 to 2021. Using financial and non-financial data, the empirical study reveals the significant impact of macroeconomic variables such as GDP growth rate, inflation, and governance index, as well as internal factors such as return on equity (ROE), on credit risk. In addition, the analysis highlights the essential role of solidarity loans and micro-insurance in mitigating this risk and improving the performance of Moroccan MFIs. These results can serve as a basis for MFIs and regulators to improve their credit risk management and strengthen the microfinance sector in Morocco.

Keywords: Microfinance ; Credit risk ; Microfinance institutions ; Financial exclusion; Risk management.

Résumé

La microfinance joue un rôle crucial dans le développement socio-économique du Maroc, mais les IMF sont confrontées à des risques spécifiques, notamment le risque de crédit, qui peuvent impacter leur performance.

Cet article se concentre sur l'analyse des facteurs déterminants du risque de crédit au sein des institutions de microfinance au Maroc, sur une période allant de 2012 à 2021. En utilisant des données financières et non financières, l'étude empirique révèle l'impact significatif de variables macroéconomiques comme le taux de croissance du PIB, l'inflation, et l'indice de gouvernance, ainsi que des facteurs internes tels que la rentabilité des fonds propres (ROE), sur le risque de crédit. De plus, l'analyse met en évidence le rôle essentiel des prêts solidaires et de la micro-assurance pour atténuer ce risque et améliorer la performance des IMF marocaines. Ces résultats peuvent servir de base aux IMF et aux régulateurs pour améliorer leur gestion du risque de crédit et renforcer le secteur de la microfinance au Maroc.

Mots clés : Microfinance ; Risque de crédit ; Institutions de microfinance; Exclusion financière ; Gestion des risques.

INTRODUCTION

Microfinance plays a crucial role in Morocco's economic and social development. Microfinance institutions offer financial services to unbanked populations and micro-entrepreneurs who would not otherwise have access to formal financial services (Wamba, Bengono, Sahut, & Teulon, 2018). This helps to promote financial inclusion and reduce poverty by enabling individuals and small businesses to access funds to develop their economic activities (Shapiro, 2015).

By offering loans, savings services and insurance tailored to the needs of low-income populations, microfinance enables borrowers to finance productive investments, launch new economic activities and diversify their sources of income (Koku, 2015). This helps to create jobs, empower individuals and communities, and contribute to economic development at grassroots level.

However, microfinance institutions in Morocco face specific challenges, particularly with regard to credit risk. Since microfinance clients often include low-income borrowers without significant collateral, the risk of default is higher than for loans granted by traditional banks. Effective management of this risk is essential to ensure the stability and efficiency of microfinance institutions (Jean Claude & Edison, 2018).

To meet these challenges, microfinance institutions in Morocco can adopt practices such as carefully assessing borrowers' repayment capacity, providing financial advice and entrepreneurial training, and setting up monitoring and support mechanisms for borrowers (Loubna, Mohammed, & Mounir, 2020) . In addition, they can strengthen their governance and risk management, by putting in place effective internal control systems and promoting transparency and accountability (Naz, Salim, ur Rehman, Ishfaq Ahmad, & Ali, 2019).

Analyzing the determinants of credit risk in Morocco's microfinance institutions is particularly important for several reasons. Firstly, the country's economic and social context influences the risk profiles these institutions face. Morocco is a developing country with a diversified economy, but one marked by economic inequalities and a high prevalence of informality. These factors can affect borrowers' ability to repay their loans and increase the risk of default.

In addition, the microfinance sector in Morocco is subject to specific regulations designed to ensure its viability and sustainability (Churchill, 2018). The Moroccan authorities have put in place a regulatory framework designed to protect borrowers, promote financial transparency and ensure the soundness of microfinance institutions. By analyzing the determinants of credit risk, we can better understand how these regulations influence borrower behavior and risk assessment by microfinance institutions.

This study aims to deepen our understanding of the determinants of credit risk in Moroccan MFIs over a period from 2012 to 2021. By analysing financial and non-financial data, we seek to identify the macroeconomic and internal variables that influence credit risk and to examine the effectiveness of certain financial instruments, such as solidarity loans and micro-insurance, in mitigating this risk.

We will seek to answer the following research question: "What are the determinants of credit risk in Moroccan microfinance institutions?

The results of this research will provide crucial insights for MFIs and financial regulators in Morocco, helping them to better understand the challenges they face in terms of credit risk and suggesting ways to improve risk management and encourage more sustained development of the microfinance sector.

The following is the structure of the remaining sections in this article, Section 1 provides an overview of the existing literature on the determinants of credit risk in microfinance institutions. Section 2 details the research methodology used, including the source of the data collected. Descriptive statistics are presented and he findings of the empirical analysis in Section 3, he findings of the empirical analysis. Finally, Section 3 discusses the results obtained and highlights the practical and theoretical implications of this study for financial risk management in the context of microfinance in Morocco.

1. Literature review

Group lending, also referred to as group or solidarity lending, is a significant innovation that has improved credit accessibility for individuals living in developing nations (Karaivanov, Xing, & Xue, 2020). This contractual approach is likely to alleviate the challenges linked to information asymmetry. In a group lending setup, borrowers are collectively responsible for loan repayment, meaning that if one member engages in risky ventures (moral hazard), the likelihood of their peers having to bear the liability increases. Consequently, group members are incentivized to assess and filter potential clients. (Adongo, 2005)

Nevertheless, other studies argue that group lending can lead to additional expenses, such as the costs associated with group contracts, training borrowers on group procedures, heightened supervision requirements, and more frequent payment obligations. These costs contribute to higher interest rates on microcredit loans, resulting in increased repayment risks (Danstun & Harun, 2020). Despite the aforementioned disadvantages of the group lending approach, we hold the belief that it will have an adverse impact on credit risk.

H1: Group loans have a negative effect on credit risk.

Insurance plays a crucial role in mitigating credit risk for vulnerable borrowers. Microinsurance, which involves collecting relatively small premiums from customers and providing substantial payouts to a small fraction of the population affected by specific risky events, offers low-income households a higher level of protection against risks related to property, death, health, and disability. This population segment is particularly susceptible to such risks. In the event of an adverse occurrence, the financial burden is shared by a large number of individuals, resulting in a significantly reduced cost or premium per person (Knewtson & Qi, 2019). Consequently, insurance emerges as an effective tool in diminishing credit risk for these vulnerable borrowers. Thus, we can anticipate a negative correlation between credit risk and insurance.

H2: Microinsurance has a negative impact on credit risk.

Promoting the empowerment of women holds great significance in the realm of microfinance due to the unique challenges they face, which are often distinct from those faced by men. Numerous studies, such as (ASSAIRH.L, 2020). have revealed that women exhibit better performance in terms of debt repayment when compared to men. Several arguments have been put forth to explain this higher rate of recovery among women. Firstly, women tend to be more risk-averse than men, as highlighted by (Owolabi, 2015). Consequently, they are inclined to choose projects with relatively lower levels of risk (Lassoued, 2017), Secondly, women generally place high value on work ethic and financial discipline. Thirdly, women often rely more heavily on MFIs due to limited opportunities for escaping poverty in developing countries, restricted access to education, and their commitment to their families and communities. These factors impede their ability to pursue alternative educational or professional prospects elsewhere. Despite the widely acknowledged notion that women borrowers exhibit a high repayment rate, some authors have questioned this relationship. For instance, (Brindley, 2005) argues that limited access to capital among women leads to greater risk. Additionally, (Leach & Sitaram, 2002) suggest

that women face greater challenges in accessing finance compared to men, resulting in their investment in traditional projects that may not be profitable or competitive, enabling them to repay their loans on time.

We expect the percentage of loans granted by women to have a negative effect on credit risk:

H3: The percentage of women borrowers has a negative impact on credit risk.

MFIs lend money to clients who do not necessarily have access to traditional banking services, and the repayment of these loans is the MFIs main source of income. Consequently, the quality of the loans in their portfolio directly affects the financial health of the institution.

A decline in portfolio quality could have several negative consequences for MFIs, including a reduction in the institution's solvency, higher funding costs and a reduced ability to attract investors. In addition, a decline in portfolio quality could damage the MFIs reputation, resulting in a loss of clients and potential future business opportunities (Jean Claude & Edison, 2018).

To maintain portfolio quality, MFIs need to put in place effective loan management systems. This includes developing appropriate lending policies, carrying out thorough client screening to ensure creditworthiness, regularly monitoring loan repayment and using effective recovery techniques in the event of default. In addition, MFIs may need to provide financial education to their clients to help them better manage their finances and avoid loan defaults.

H4: financial performance negatively affects credit risk.

Among other things, we focus on macro-institutional and economic determinants. In fact, judicial and institutional disparities appear to give rise to different bank lending policies (Zhong & Zhou, 2020) because better institutional environments are able to overcome information asymmetries in credit markets. It can be assumed that if the inflation rate is high, borrowers may find it more difficult to repay their loans, as the cost of living would be higher and they may have fewer resources available This could lead to an increase in the 30-day PAR in microfinance institutions. On the other hand, if the inflation rate is low, borrowers could find it easier to repay their loans, which could result in a decrease in the 30-day PAR.

H5: Inflation has a negative impact on credit risk.

It can be assumed that if the GDP growth rate is high, businesses and borrowers could be more likely to repay their loans, as they would have more financial resources at their disposal. This could result in a reduction in the 30-day PAR in microfinance institutions (Formanek & Tahal, 2018) . On the other hand, if the GDP growth rate is low, borrowers could find it more difficult to repay their loans, which could lead to an increase in the 30-day PAR.

H6: the growth rate has a negative impact on credit risk

2. Data and research methodology

2.1. Data sources

As part of our research, we obtained the necessary data from the Microfinance Information eXchange (MIX) database, which provides information on microfinance institutions in the Moroccan sector. Our sample consists of 10 Moroccan MFIs over a period ranging from 2012 to 2021.

2.2. Description of variables

Table 1 provides a comprehensive description of all the variables utilized in our study, along with the anticipated signs of the corresponding coefficients.

Table 1: *Description of variables*

Variables	Description of variable
PAR	: portfolio at risk
WOM	: percentage of women borrowers
INSURANCE	: microinsurance
GRP	: group lending
INFLATION	: inflation
GDP	: GDP growth rate
GOV	: index governance
ROA	: Return on Assets
ROE	: Return on Equity
AGE	: Age of MFI

Source: The authors

3. Results

3.1. Descriptive statistics

Table 2 provides summary statistics for various variables. The mean, median, maximum, minimum, and standard deviation are provided for each variable. The variables include PAR, WOM, INSS, GRP, INF, GDP, GOV, ROA, ROE, and AGE_IMF. These statistics give insights into the central tendencies, dispersion, and extreme values of the data for each variable.

Table 2: *Summary statistics*

	Mean	Median	Maximum	Minimum	Std. Dev.
PAR	0.052200	0.040000	0.100000	0.030000	0.025754
WOM	0.482200	0.485000	0.520000	0.440000	0.027398
INSS	0.508900	0.545000	0.680000	0.230000	0.150540
GRP	0.247830	0.270000	0.320000	0.160000	0.045743
INF	0.012500	0.010500	0.026000	0.004000	0.006408
GDP	0.021900	0.028500	0.045000	-0.063000	0.030096
GOV	-0.158000	-0.120000	-0.070000	-0.330000	0.082487
ROA	0.040710	0.040200	0.070000	-0.008700	0.022657
ROE	0.116870	0.107250	0.196000	-0.016800	0.069560
AGE	19.50000	19.00000	32.00000	11.00000	4.908249

Source: Author's calculations, Eviews 10 software

Table 3, generated with Eviews 10 statistical software, displays the correlation matrix of the independent variables utilized in the regressions. The authors possibly presumed the strong correlation (r = 0.77) between Between "ROA" and "ROA".

Table 3: *Correlation matrix*

	INSS	WOM	GRP	INFL	GDP	GOV	ROA	ROE	AGE
INSS	**1**								
WOM	-0,504	**1**							
GRP	-0,231	0,732	**1**						
INF	0,366	-0,206	-0,341	**1**					
GDP	-0,319	0,410	0,536	-0,186	**1**				
GOV	0,355	0,029	-0,233	0,088	-0,237	**1**			
ROA	-0,453	0,471	0,678	-0,316	0,646	0,081	**1**		
ROE	-0,388	0,233	0,62	-0,294	0,717	0,005	0,775	**1**	
AGE	0,282	-0,435	-0,437	0,226	-0,240	-0,090	-0,550	-0,517	**1**

Source: Author's calculations, Eviews 10 software

Our linear panel data model can be specified as follows:

$$Y\_it = \beta0 + \beta1X1\_it + \beta2X2\_it + ...+ \beta k*Xk\_it + \alpha\_i + \varepsilon\_it$$

Where:

- i : individual unit (Moroccan microfinance institutions).
- t : period of time (the years from 2012 to 2021).
- Y_it : dependent variable for (PAR-30) of MFI i observed at date t.
- X1_it, : independent variables for unit i at period t.
- β0,., βk : coefficients for independent variables.
- α_i : fixed or random effect of unit i on the dependent variable.
- ε_it : error term.

The first step is to check the homogeneity or heterogeneity of the specification generator's process data by adopting a homogeneity test procedure, such as that presented by Hsiao.

The results of the statistical tests show that the Fisher F1 statistic has a value of 8.25 with a p-value of 0.00, indicating a significant difference between groups in constants and coefficients. The Fisher F2 statistic has a value of 2.40 with a p-value of 0.11, suggesting homogeneity of coefficients. The Fisher F3 statistic has a value of 19.60 with a p-value of 0.00, revealing significant differences between individuals (Table 4).

The constants and coefficients show a significant difference between groups, while the coefficients remain homogeneous and the panel structure is preserved. In addition, significant differences between individuals are observed, justifying the use of the individual effects model.

Table 4: *Test of homogeneity*

homogeneity	F- stat	P-value
F1	8,25	0,00
F2	2,40	0,11
F3	19,60	0,00

Source: Author's calculations, Eviews 10 software

Once the individual effects model has been selected, it is essential to determine whether the Fixed Individual Effects Model (FEAM) or the Random Individual Effects Model (REAM) is appropriate for estimating the relationship under study.

To make this decision, the Hausman test can be used (table 5) . The probability provided by the program is 0.6256. Therefore, we cannot reject the null hypothesis and should favor the adoption of a random effects model.

Table 5 : *Résultats du test d'Hausman*

Correlated Random Effects - Hausman Test
Equation : Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.378458	9	0,6256

* Cross-section test variance is invalid. Hausman statistic set to zero.
** WARNING: estimated cross-section random effects variance is zero.

Source: Author's calculations, Eviews 10 software

We use the Likelihood Ratio Test (LR Test) to detect heteroscedasticity using Eviews-10 software. According to our results (Table 6), The regression has a p-value of 0.22, which means that we cannot reject the null hypothesis that the data are homoscedastic.

Table 6: *Test of heteroscedasticity*

Panel Period Heteroskedasticity LR Test
Null hypothesis: Residuals are homoskedastic
Equation : UNTITLED

	Value	df	Probability
Likelihood ratio	25.51808	9	0.2200

LR test summary:	Value	df
Restricted LogL	74.43047	28
Unrestricted LogL	87.18951	28

Source: Author's calculations, Eviews 10 software

3.2. Model estimation

The model, generated with Eviews 10 statistical software, shows that group lending (GRP), percentage of women borrowers (WOM), growth rate (GDP), governance index (GOV), return on assets (ROA), and inflation rate (INFLATION) have a significant impact on portfolio at risk (PAR), while INSURANCE and AGE_IMF have no significant impact.

The coefficient of determination R^2 is high at 0.8904, suggesting that the model explains the portfolio-at-risk variance (PAR) well. The adjusted coefficient of determination R^2 is also high at 0.8808. The F-statistic has a high value of 92.45, with an associated probability of 0.0000, suggesting that the model as a whole is statistically significant.

Table 7: *Model estimation*

Dependent Variable : PAR_30
Method: Panel EGLS (Cross-section random effects)
Date : 03/08/23 Time : 01:32
Sample: 2012 2021
Periods included : 10
Cross-sections included : 10
Total panel (balanced) observations : 82
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GRP	-0.134245	0.047560	-2.822646	0.0058
WOM	-0.742605	0.106103	-6.998878	0.0000
INSS	0.004101	0.012121	0.338330	0.7359
INFL	0.721628	0.283636	2.544204	0.0126
GDP	-0.371509	0.087471	-4.247221	0.0001
GOV	-0.251509	0.064473	-3.547236	0.0031
ROA	-0.631538	0.282310	2.237037	0.0277
ROE	-0.046887	0.073579	-0.637238	0.5256
AGE	8.19E-06	0.000225	0.036465	0.9710
C	0.420193	0.047333	8.877287	0.0000

Effects Specification		
	S.D.	Rho
Cross-section random	0.065363	0.2293
Idiosyncratic random	0.208235	0.7700

Weighted Statistics			
R-squared	0.890438	Mean dependent var	0.052200
Adjusted R-squared	0.880806	S.D. dependent var	0.025754
S.E. of regression	0.008892	Sum squared resid	0.005734
F-statistic	92.44757	Durbin-Watson stat	1.835388
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.890438	Mean dependent var	1.208940
Sum squared resid	1.208940	Durbin-Watson stat	1.495861

Source: Author's calculations, Eviews 10 software

The negative coefficient of the group lending variable (GRP) indicates that when the group lending decreases, the level of portfolio at risk at 30 days (PAR) increases.

The negative coefficient on the percentage of women variable (WOM) suggests that when the proportion of women in the population decreases, the level of portfolio at risk at 30 days (PAR) also increases.

The microinsurance variable "INSURANCE" has no significant impact on portfolio at risk at 30 days (PAR), as indicated by its high coefficient and p-value.

The positive coefficient on the "INFLATION" variable suggests that when the inflation rate rises, so does the level of 30-DAY portfolio at risk (PAR).

The negative coefficient of the "GDP" variable indicates that when GDP decreases, the level of 30-day portfolio at risk (PAR) increases.

The positive coefficient of the variable "ROA" indicates that when the return on assets decreases, the level of portfolio at risk at 30 days (PAR) also increases.

The negative coefficient on the "ROE" variable suggests that when return on equity decreases, the level of 30-day portfolio at risk (PAR) also increases.

The coefficient of the "AGE" variable is very low, suggesting that it has no significant impact on 30-day portfolio at risk (PAR).

The constant term "C" is significant and positive, indicating that even in the absence of the other independent variables, there is a constant value of portfolio at risk AT 30 DAYS (PAR).

The adjusted R-squared is high (0.88), indicating that the independent variables of the regression explain well the evolution of the 30-day portfolio at risk (PAR).

The S.E. of the regression is low (0.0089), indicating that the predicted values of portfolio at risk at 30 days (PAR) are close to the observed values.

The F-statistic is high (92.45), indicating that the regression model is globally significant.

4. Discussion of the results

The results of our research indicate that several factors determine credit risk within MFIs. These include micro-insurance, solidarity lending, inflation and GDP.

Our results indicate that joint lending can reduce credit risk. Solidarity lending is a form of collective guarantee where members of a group act as guarantors for each other. This form of guarantee can reduce the risk of default by creating social pressure on group members to repay their loans. These results are consistent with those of a previous study by (Serrano-Cinca, Gutiérrez-Nieto, & Reyes, 2016), which also showed that solidarity lending can reduce credit risk by creating social pressure on group members to repay their loans.

Thus, our results confirm Hypothesis 1 that solidarity lending negatively affects credit risk within Moroccan MFIs.

Our results confirm that women are often considered more reliable borrowers than men, supporting Hypothesis 3 that the percentage of women borrowers negatively affects credit risk in Moroccan MFIs.

This finding is consistent with several previous studies conducted in the microfinance field. For example, a study conducted by (Nasrin, Baskaran, & Rasiah, 2017) demonstrated that women borrowers have a lower default rate than male borrowers in MFIs. The authors of this study concluded that women's financial inclusion can be beneficial for MFIs, as they represent a stable and reliable source of income, in addition, a study conducted by (Karlan & Zinman, 2011), revealed that women's financial inclusion can help reduce poverty and improve household socio-economic conditions. The authors suggested that MFIs can play a key role in promoting women's financial inclusion and reducing gender inequalities.

Our results highlight the significant relationship between the governance index and credit risk in Moroccan microfinance MFIs. The studies reviewed consistently suggest that governance quality plays a crucial role in MFIs' financial performance and ability to manage credit risk.

A study conducted in Tunisia by (Nawaz, Iqbal, & Ehsan, 2018) found that governance quality had a significant impact on MFIs' financial performance, as well as their ability to manage credit risk. This finding indicates that strong and transparent governance practices are essential for reducing credit risk within MFIs.

Our results confirm hypothesis 7, according to which the growth rate negatively affects credit risk in Moroccan MFIs. They underline the importance of taking macroeconomic factors such as inflation and growth rate into account when assessing the credit risk of MFIs.

Furthermore, our results are consistent with a study by (Calderon-Contreras, Ostos, Florez-Garcia, & Angulo-Bustinza, 2022). which also showed that GDP has a negative impact on credit risk. This consistency between the two studies reinforces the validity of our results and underlines the importance of GDP as a determining factor for credit risk within MFIs.

Also, our results confirm that an increase in the 30-day PAR can lead to an increase in loan losses for the financial institution, which can affect its ROA and ROE.

Our results show no significant correlation between MFI age and the dependent variable PAR at 30 days, suggesting that there is no clear linear relationship between these two variables. In other words, the age of the MFI does not appear to play a significant role in determining the probability that loans granted by the institution are past due at 30 days, these results are in contradiction with some previous studies that suggest that the age of an MFI can be a determining factor in the quality of its loan portfolio. For example, a study by (Gul, Podder, & Shahriar, 2017) found a negative relationship between MFI age and the proportion of loans in arrears. According to this study, older MFIs generally have a higher-quality loan portfolio.

Conclusion

In this study, we sought to deepen our understanding of the impact of microfinance on socio-economic development in Morocco by focusing specifically on credit risk within microfinance institutions (MFIs). Microfinance plays a crucial role in financial inclusion, providing access to financial services to vulnerable populations and budding entrepreneurs, thereby contributing to poverty reduction and economic development.

The empirical analysis carried out between 2012 and 2021 identified several factors that determine credit risk in Moroccan MFIs.

The results show that macroeconomic variables such as the GDP growth rate, inflation and the governance index play a significant role in assessing credit risk. These external factors can have a considerable impact on borrowers' repayment capacity and, consequently, on MFI performance.

Internal factors, such as return on equity (ROE), also play a crucial role in credit risk management. An MFI with a better return on equity is more likely to cope with defaults and better manage the risks associated with the loans it grants.

Encouragingly, the analysis also highlights the beneficial role of solidarity loans and micro-insurance in mitigating credit risk and improving the performance of Moroccan MFIs. These financial instruments offer protection against unforeseen risks and strengthen borrowers' ability to cope with financial difficulties, thereby helping to reduce defaults.

By combining these results, MFIs in Morocco can use this knowledge to better assess and manage credit risk, taking into account both macroeconomic and internal factors. These results can also be useful to regulators and policy makers in designing policies and measures to strengthen the microfinance sector in the country.

In sum, this study makes a significant contribution to understanding the determinants of credit risk among MFIs in Morocco. By identifying the variables that influence this risk, this research offers avenues for improvement for MFIs and the stakeholders concerned in order to consolidate the crucial role of microfinance in the country's socio-economic development.

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