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December 2022

Working paper No. 2022 – 09

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Dynamic analysis of the interest rate determinant in microfinance institutions

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Abstract

In this paper, we examine the interest rate of microfinance institutions in a dynamic framework in order to consider the anticipation phenomenon. The fluctuations that affect the development of MFIs are often unpredictable and may be fast. The results show an interest rate increase over time, which is more significant within cooperatives and Non-Governmental Organizations (NGOs) compared to other MFIs categories. Our results clearly show that these MFI types suffer from more exogenous shocks.

Keys words : interest rate, microfinance, GMM-System, Dynamic panel, Fisher test statistic

JEL Code : G2 ; G21 ; C1 ; E43, N20

1 Introduction

The increase in MFI interest rates observed in most countries over the past decade has motivated some researchers (Dorfleitner et *al.* 2013; Tchakoute-Tchuigoua,2012; Roberts, 2013; Basharat et *al*.2015; Gutiérrez-Nieto et *al*. 2017; Nwachukwu et *al*.2018; Faye et Ratsimalahelo, 2019). The main purpose of these studies was to understand the factors determining the MFI viability and their financial and social performances. They were constructed on the estimations of static econometric models. However, these static analyses do not provide adequate explanations for present and future MFI interest rate fluctuations. This is because the adjustments in the financial environment of MFI are not instantaneous.

Moreover, these models ignore the dynamic characteristics of the microfinance decision managers, financial incomes, and operating costs which are the most important factors in determining interest rates. This paper fills this gap by providing a dynamic panel data analysis of interest rate determinants. We use a database of 897 microfinances institutions from 106 developing countries around six geographic regions from 2003 to 2020. To our knowledge, no dynamic panel data analysis deals with the determinants of the interest rate. A dynamic model allows a better explanation of the interest rate fluctuations of microfinance institutions.

In addition to these limitations, those works failed to test the effects of the MFI's legal status on interest rate fluctuations. The legal status includes non-governmental organizations (NGOs), credit unions/cooperatives (CU), rural bank (RB) non-bank financial institutions (NBFIs), and micro-banks (BANK). The differences according to the MFI's legal status are likely to lead to differences in the strategies and objectives pursued by MFI. Empirically, NGO is a dummy variable that takes a 1 (one) value if the MFI is registered as NGO and 0 for the other institutions' types. The other legal status is defined in the same way. These dummy variables created for different microfinance institution types follow from the MIX Market analysts and utilized in different studies (Nwachukwu et *al*. (2018); Hermes et *al*. (2011). To test the effect of qualitatives variables (ONG, CU, BANK, RB, and NBFI) on interest rate fluctuations, the null hypothesis that we consider is a linear combination of the regression coefficients. We propose the Fisher (F) statistic test to test this null hypothesis. To the best of our knowledge, there is no published evidence relating to the test of the null hypothesis of MFIs interest rate

fluctuations and the status. This paper reduces these limitations by using a more rigorous econometric method.

We also identify, the threshold above which the proportion of women in microfinance institutions has a positive and negative effect on the interest rate.

This paper considers a different analysis from the above-mentioned literature. By using a dynamic approach, the main question we ask in this paper is whether the increase in interest rates is not tied up with the anticipation phenomena. That is a system whose properties depend on its evolution over time and not just the descriptive properties of the current system. It is important to distinguish between the current and long-term effects of explanatory variables on MFI interest rate changes.

Three questions, in particular, are broached:

- Can we find determinants justifying the anticipation of the interest rate of MFI evolution over time?
- Can the interest rate evolution of microfinance institutions be better interpreted according to these determinants?
- Finally, is there a disparity in the interest rate evolution according to the MFI's legal status?

To answer these questions, we use the GMM-System estimation for dynamic panel data (Bond, 2002).

We use a multivariate analysis to account for the effects of internal and external factors on the interest rate of MFIs.

In the first question, our approach is valuable in showing the short- and long-term dynamic effects. This consist of combining lagged and level variables to show whether there exists a relation between the value of the interest rate at *t* and *t-1* period. The coefficient associated with the lagged variables represents the anticipation coefficients. If it is positive and significant, this means that the trend will continue and that the MFIs anticipate a rising interest rate; and conversely, if it is negative and significant, they anticipate an interest rate decrease; if it is equal to zero, the MFIs anticipate that the interest rate evolution at period *t-1* will be identical to that observed at *t* period, as in static models.

To answer the second question, we show that the results from the dynamic analysis method provide more and better information about MFI interest rate fluctuations.

Finally, the third question deals with the different legal statuses of MFIs and the results show that NGOs and rural banks do not often meet expectations concerning solidarity practices. However, our findings suggest that we reject the hypothesis that MFIs' interest rate is independent of their legal status.

The remainder of the paper is organized as follows. In Section 2, we present the literature review. Section 3 presents the data and the variables and discusses the advantages of the econometric model (Generalized Method of Moments system) in a dynamic framework. In Sections 4, we present and discuss the empirical results. Section 5 provides impact of the effect of legal status of microfinance institution on the interest rate**.** We conclude with the research perspectives in Section 6.

2 Literature review

Recent theoretical developments have shown that the microfinance interest rate depends on several characteristics. These include the market structure, the client's categories, the MFI's legal status, internal and external factors, and macroeconomic factors.

However, as with classical banks, the relationship between these factors and the interest rates of MFIs has been embryonically discussed in the literature (Dorfleitner et *al.*2013). The literature has focused mainly on the factors explaining the MFIs profitability without considering the interest rate's evolution. Cull et *al.* (2007) examine the determinants of financial viability of the MFIs using a MIX (Microfinance Information Exchange) database for the period 1992–2002. They report that interest rates and refinancing costs affect the financial viability of MFIs. Rosenberg et *al.* (2013), Gonzalez (2010) argue that while MFIs have higher yield rates than classical banks, rent-seeking is not a decisive element for this interest rate. Using data from 206 MFIs in 33 African countries, Churchill (2018) has shown that there is no existence of a threshold beyond which interest rates cause profitability to decline. In other terms, there is no threshold beyond which higher interest rates can be associated with loan delinquencies. They argue that various reasons may explain these results like the high macroeconomic growth rate of Sub-Saharan Africa and also the lending methodology used.

Despite the significance of their results, further research would be required because these authors haven't developed these conclusions: there is no information about the dynamic explanatory variables, the econometric method, or the statistical significance of certain results.

Other empirical studies look at the subsidies (D'Espallier et *al*.2017) to explain the interest rate evolution. According to these authors, the uncertainty of the subsidies makes it difficult for the MFIs achievement objectives, and meaning their social mission loses direction and consequently causes an upward interest rate adjustment.

Relating to the MFI objectives, some authors like Gonzalez (2010) argue that microfinance cannot generate high profits because it still supports high costs by generating low incomes. Berg et *al*. (2020) have shown that there is no perceptible effect at low levels of MFI coverage, but when the MFI coverage is high enough, the moneylender interest rate increases significantly. Sun and Im (2015) focuses his study on stakeholders mainly on female borrowers, borrower communities, managers, employees, and governments. They had shown that every stakeholder of MFIs could contribute to cutting the interest rate and accomplishing their social mission by combining different resources that could help to generate new opportunitye.

Other authors like Rodríguez-Fernández et *al*. (2009) emphasize the correlation between market structure or competition and interest rate. According to these authors, this relationship depends on how market power is assessed. If this assessment is based on the Lerner index, the results show that greater market power implies high-interest rates. However, contrary results arise in this market power is evaluated using the concentration index.

Ahlin et *al.* (2011) highlight the national context's effect, especially macroeconomic and macro institutional characteristics to explain the financial performance of MFI. They find in their study that MFIs set up in financially important economies have lower operating costs and fewer defaults, and therefore lower interest rates. Mersland et Strøm (2012) identifies a positive relationship between financial costs and interest rate and a negative relationship between the efficiency of MFI level and the interest rate. According to Sun and Liang (2021) MFI's average portfolio-loan interest rate (as a proxy for the affordability of microfinance to the poor) is negatively correlated with the degree of its country's social globalization and has an inverted U-shaped correlation with the degree of its country's economic globalization. They use a

sample of 2030 MFI-year observations across 50 emerging countries over the period of 2002–2012 from the Microfinance Information Exchange (MIX).

Roberts (2013), Gutiérrez-Nieto et *al*. (2017), Cotler and Almazan (2013) highlighted the MFIs effect specific characteristics. Roberts (2013) identifies a positive relationship between profit orientation and the interest rate. Tchakoute-Tchuigoua, (2012) analyzes the effect of the lending methodology and the decentralization of the credit decision on the terms of the loan agreement using the Hausman-Taylor estimator. He identifies a positive relationship between the village bank and the real yield rate on the gross portfolio. Gutiérrez-Nieto et *al.* (2017) identify drivers of the poverty penalty in a sample of MFIs from 17 countries by focusing on the Colombian case and using three tests: two means tests, a parametric (ANOVA) and a non-parametric (Mann-Whitney). They conclude that operating costs are the most important factor in explaining effective interest rates. Other factors, such as risk, cost of funds, or profitability, are relevant in some regions.

Studying the relation between the performance of MFIs and microfinance lender interest rate, Berguiga and Adair (2019) have shown that cost of funding, return on assets, and the number of credit clients have a significant positive impact on lending interest rate around the world. However, depth of outreach as depicted by average loan size, has a significant inverse relation with lending interest rates. In this Perspective, Xu et *al*. (2020), analyzing group and individual lending using data from 26,579 loan-specific observations in 2014- 2016 for CFPA (Chinese Foundation for Poverty Alleviation), proove that the higher repayment risk of individual lending was likely compensated by higher interest income.

Despite this extensive literature, some of these results are empirically weak, and the question of interest rate of MFI anticipation setting remains unanswered. In other words, anticipation phenomena have never been studied in the microfinance literature. Another contribution from that paper is highlighting of a threshold effect between women borrowers and the interest rate. Most authors who study the effect of female borrowers on interest rates estimate that a rise in MFI female clientele causes an increase in interest rates (Dorfleitner et *al.*2013). In this paper, we show that this relationship is not linear and above a certain threshold, about 68 percent, the positive impact of women borrowers on the interest rate becomes negative.

Microfinance institutions adopt different legal statuses like NGOs, Non-bank financial institutions (NBFIs), credit unions/ cooperatives (CU), Rural bank (RB), and micro-banks (banks). NBFIs and microbanks are shareholder-oriented organizations targeting traditional financial performance metrics (Rodríguez-Fernández et *al*.2009). Credit unions/cooperatives and NGOs are not for-profit organizations. Members of credit unions/ cooperatives are the owners of these institutions and exert control over strategic decisions.

Surpluses are retained to serve the capital or distribute to members, directly via cash dividends or indirectly via low-cost access to credit and deposit services. Access to external funding is limited and owners are involved in microfinance management. However, NGOs are characterized by a non-distribution constraint (Servin et *al*.2012). The range of financial services provided by NGOs is rather limited given that these institutions cannot accept the deposits. The dependence on external funding such as grants (rather than shareholder capital) makes them less responsive to changes in demand and supply conditions. NGOs are commonly associated with lower profitability, smaller loan sizes, and higher costs per loan compared to commercially micro-banks oriented (Cull et *al.*2011).

3 Data and definitions of variables

In this section, we first describe the variables that we are using. In a second step, we specify our econometric model and its contributions to the literature.

3.1 Data

To further this research on microfinance interest rate determinants, we used a database from the MIX, a non-profit organization tasked with collecting all information on microfinance institutions worldwide to facilitate exchange among MFIs. It aims to foster a microfinance market, to enable comparison among MFIs, and provide performance monitoring tools and data collection services. It allows easy access to financial and social performance information for over 2.000 microfinance institutions worldwide, covering 92 million borrowers. The MIX is earmarked for financial inclusion and transparency in the microfinance sector.

We used a database containing 897 microfinance institutions. This sample provided us with a complete framework allowing us to consider all the factors that may influence the interest rate economically, socially, historically, or geographically. The paper spans 17 years (2003 - 2020). The choice of the period stems from a lack of information about certain variables before 2003 and after 2015. This sample is implemented by a multi-step adjustment. In the first sampling phase, considering that the MIX distinguishes the social and financial performance based on diamond classification on a scale of 1 to 5, we only used MFIs that had reached 3 diamonds. This was done to have reliable external reporting (financial audit).

In the second phase, we removed from the sample those MFIs with negative gross loan portfolio values of less than USD 20,000 and those with operating costs greater than 350 percent. In the final phase, MFIs with missing values or information in the database for the period in question (2003–2020) were also removed from the sample.

3.2 Description and operationalization of the variables

We have selected a set of variables that are considered essential. Some of these variables have been highlighted by other authors (Cotler and Almazan, 2013). These different variables are defined in Table1.

Tableau 1: Definitions of variables

Variables characteristics	**Variables identity**	**Measures**	**Definition**
Dependent Variable	Real interest rate	RIR	Nominal interest rate - Inflation rate. This ratio represents the total income of cash flow generated by the loans additional to fees and commissions and the income of the obligatory deposits (source: MIX). It is calculated as a percentage.
Internal Factors	Operating costs rate	OC	Operating cost/ Average Gross loan portfolio, i.e. the costs needed to provide credit services. Source : author
	Financial costs rate	FC	Equity access (Financial expenditures) / Average Gross loan portfolio (Source: Mix).
	Women borrowers rate	WB	The number of female borrowers / Total number of clients in MFI. (Source : Mix).

	Average loan size	ALS	Gross loan portfolio / Number of active borrowers. (Source: Mix). The currency unit is the U.S. dollar (USD).
	Average gross loan portfolio	AGLP	All receivables held by an institution from its members or clients. (Source: Mix). The currency unit is the U.S. dollar (USD).
	Loan loss rate	LLR	(Write-offs - Value of Loans Recovered) / Average Gross Loan Portfolio. (Source : Mix).
	Average deposits	AD	The ratio between the funds, other than contributions collected by the MFI from its members or clients with the right to dispose of them in the course of its activity and the total Average gross loan portfolio. Calculated from Mix data. The currency unit is the U.S. dollar (USD).
	Profit rate	PR	Marginal Profit x Financial income/Average Gross loan portfolios = Net profit / Average Gross loan portfolio = Capital / Average Gross loan portfolio. (Source : Mix). It is calculated as a percentage.
	Portfolio-at-risk at 30 days ratio	PAR-30	The outstanding loan with repayment term > 30 days / Average Gross loan portfolio. This ratio measures the quality of the portfolio. Standard <5 percent.
	Write-off ratio	WOR	Write-Offs / Average Gross Loan Portfolio. It represents the total amount of loans written-off during the period. Source : Mix.
	Competition	COMP	It represents the market share of each MFI in the country. Market shares are obtained by relating the active borrowers of MFI to the number of active borrowers of all MFIs in the country. It is measured by Herfindahl–Hirschman Index.
External factors	Inflation rate	INFL	INFl = Yield nominal rate - Yield real rate. Inflation is defined as the general increase in the price level. Higher inflation affects deposit and lending terms of the microfinance institution. Source : Author.
	Regulation	REG	This field is marked as 'Yes' if the entity is submitted to some regulatory authority, whether a formal banking regulator or some other financial services regulator. This most often concerns entities listed as Banks and Non-Bank Financial Institutions (NBFIs), but may also include Credit Union / Cooperatives or Non-Governmental Organizations (NGOs) in some markets.
	Gini per capita	GINI	The Gini per capita income ((USD) is an economic indicator relative to each country. It is gross national income divided by the midyear population of the country. Source : Mix.

Legal Status	Bank	BANK→	Banks are conventional financial institutions licensed and regulated by banking supervisory agencies that offer microcredit and certain banking services. It is a dummy variable that takes 1 if an MFI is registered as a Bank, 0 otherwise.
	Credit Union	CU-→	These entities are not-for-profit organizations that collect their member's savings and reallocate them in the form of loans to other members through interest rates. It is a binary variable take 1 if the MFI is registered as a CU, 0 otherwise.
	Rural Banks	RB→	These below the poverty line. It is a binary variable that takes value of 1 if the MFI is a RB, 0 otherwise.
	Non-Governmental Organizations	NGO→	These are not-for-profit organizations that serve as financial intermediation and credit manager between investors in developed countries and borrowers in developing countries. It is a binary variable that takes value 1 if the MFI is an NGO, 0 if not.
	Non- Banking Financial Institutions	NBFI→	NBFIs are formals financial institutions (often unregulated) that often operate without saving, according to the legislation of a given country. It is a binary variable that takes value 1 if the MFI is an IFNB, 0 otherwise.

Source**:** Author, (2020).

3.2.1 Dependent variable

We used the real interest rate (RIR) as a dependent variable at the expense of the real yield rate. The MIX does not explicitly provide this interest rate for various reasons, including reasons of confidentiality, to ensure transparency between borrowers and microcredit providers. It is also associated with the diversity of applied interest rates and fixed banking fees. This

makes it difficult to assign a uniform interest rate to each MFI. In this way, the interest rate considered in this paper derives from the nominal interest rate (NIR). The inclusion of loan loss arises from the fact that when customers stop repaying their debt, the nominal yield rate (real interest paid) is on a slightly downward trend compared to the facial interest rate (the total interest they would have paid if they had continued to repay their debt).

3.2.2 Control variables

Among the internal factors, we utilize the operating costs, measured as a ratio, and approximated by MIX. This variable gives us an understanding of the impact of administrative, personnel, and depreciation costs on the MFI interest rates. Some authors find that it is the most determining factor for interest rate variations. Cotler and Almazan (2013) reports that overhead costs fluctuate between 10 and 25 percent and are the most decisive element in setting interest rates (62 percent).

The second internal variable represents the financial costs (FC) or refinancing costs from donors, banks, or other MFIs. Sometimes, it represents interest-carrying debts to be repaid. In recent years, financial costs have continually increased with MFI growth and a decline in potential lenders.

This has led MFIs to turn to commercial lenders who charge higher interest rates.

The third variable influencing the interest rate is the percentage of women using the MFIs services.

The WB are a very active part of the microcredit market and are therefore an appropriate target for MFIs. Moreover, it is estimated that 70 percent of the poor in the world and 85 percent of the poorest clients for microfinance services are women. This represents a significant and growing potential for the informal economy. Commercially, several studies have demonstrated that women's loan recovery from women's is higher than that from other borrowers.

To this is added the ALS (the average loan size) which represents the volume of credit granted by the MFI for an active borrower. It makes it possible to evaluate the impact and depth of the MFIs and therefore it's level of social performance. In this order, Forcella and Hudon, (2016) show that providing loans larger than microcredits is linked to better environmental performance.

As for the AGLP (Average Gross loan portfolio), it is a financial indicator that includes total loans outstanding on the balance sheet of MFI at a given time *t*. However, it doesn't consider loans that haven't been paid as well as those that have already been written off by creditors.

The loan loss rates (LLR) variable allows considering the loans that have been recorded after each accounting period.

AD (Average Depositor) is a ratio that shows the ability of the MFI to attract external savings and retain clients. An increase in this variable shows that microfinance institutions are not obliged to go into debt to finance their loan portfolios, or to be dependent on capitalized grants, which often have a counterpart. The PR (Profit rate) Measures the ratio of operating revenue remaining after all financial, loan-loss provision, and operating expenses are paid. It contributes a large part to the Interest rate of MFI charged. Rosenberg et *al*. (2009) emphasize that the annualized interest rate on loans was above 85 percent (not including the 15 percent tax paid by clients), producing an annual return of 55 percent on shareholders' equity. PAR-30 represents the value of all outstanding loans that have one or more installments of past due to principal for more than 30 days. It shows the portion of the portfolio that is "contaminated" by arrears and therefore at risk of not being repaid. It also does not include loans that have been restructured or rescheduled. The older the delinquency, the less likely loan will be repaid. Generally speaking, any portfolio at risk (PAR-30) exceeding 10 percent should be cause for concern, because unlike commercial loans, most microcredits loans are not guaranteed.

WOR (Write-off-Ratio) provides the value of loans written-off relative to the average gross loan portfolio. The writing off of a loan affects the gross loan portfolio and loan loss equally. It is an accounting transaction that prevents assets from being unrealistically inflated by loans that may not be recovered. We expect an increase in this variable will cause an interest rate increase.

External factors are represented by COMP, INFL, REG, and GINI/CAPITA. These parameters are partly independents factors of the MFIs decisions.

Competition (COMP) represents the market share of each MFI in the country. Market shares are obtained by relating the active borrowers of MFI to the number of active borrowers of all MFIs in the country. Gonzalez (2010) shows that the financial structure of the MFI like competition and its relationship with the interest rate can be explained with the Profit-Incentive.

COMP is measured by Herfindahl–Hirschman Index:

$$COMP_{j,t} = \frac{1}{\sum_{i=1}^{Ni_t^j} \left(\alpha_{i,t}^j\right)^2} \quad \text{with} \quad \left(\alpha_{i,t}^j\right)^2 = \frac{NB_{i,t}^j}{\sum_{k=1}^{Ni_t^j} NB_{k,t}^j} \tag{01}$$

$COMP_{j,t}$: is the competition in country *j* at *t* period ; Ni_t^j is the number of MFIs in *j* country at *t* period; $NB_{i,t}^j$ is the number of active borrowers for the MFI *i* in *j* country at *t* period; $NB_{k,t}^j$ is the number of active borrowers for MFI *k* in country *j* at *t* period.

INFL (Inflation) is a macroeconomic concept. It results from a general and lasting increase in the price level, which consequently leads to the loss of the currency purchasing power. This persistent phenomenon that increases overall prices and is overlaid by sectoral price changes. This situation causes a deterioration of the financial market because MFIs will have to make a trade-off between a higher interest rate that aims to contain inflation and improve the loan portfolio and a lower interest rate to encourage household demand for credit. Cotler and Almazan. (2013) have shown that the annual inflation rate of approximately 7 percent per year in three continents, had caused high real interest rates. The microfinance regulation (REG) helps prevent, and reduce MFI instability and protects the consumers against illegal practices. The type and level of regulation depend on how the microfinance institute (NGO, Banks, NBFI, CU, RB) is formed and what services it provides. Nyanzu et *al*. (2019) find that regulation helps improve the sustainability and breadth of outreach but not the depth.

Gini per capita (GINI) is an economic indicator that measures the total income received by the country, during an accounting year. It is the sum of added values by all resident producers, product taxes not included in the valuation of output and net receipts from primary incomes.

The third category of variables considered in this paper is the qualitative factors that can act directly or indirectly on interest rate fluctuations. These variables are the legal environment (whether the MFI is regulated or not), the legal status of the MFI (NGO, NBFI, CU, or RB and BANK).

3.3 Methodology

The main purpose of the econometric approach is to examine the importance of all the above-mentioned factors using a dynamic panel regression analysis. Almost all available studies of the MFIs interest rates determinants are too often limited to a static approach, as is the case we refer to Dorfleitner, 2013; Rosenberg, 2013; Roberts, 2013; Basharat et *al*.2015; Gutiérrez-Nieto et *al*. 2017; Nwachukwu et *al*.2018. In effect, the studies, so far recalled, allow the correction of possible heteroscedasticity (generalized least squares method) and serial autocorrelation of residuals.

These studies did not consider the inter-temporal variations of the interest rate. The purpose of this paper is to correct the shortcomings observed in the static model by using a dynamic model.

The generalized method of moments (GMM) model is focused on favor of static models to control for possible endogeneity bias. It is possible that the decision determining interest rate is an endogenous choice and the current interest rate can be influenced by the previous credit risk, financial cost, operational cost or profit. While it is often difficult to get relevant instruments to remove endogeneity bias statistically, panel data offers more opportunities to do so than cross-sectional data (Deaton, 1995). In this regard, the GMM estimator is appropriate (Wintoki et *al*.2012) because it generates instruments using both lagged dependent and differences for explanatory variables. Specifically, we use system GMM model (Blundell and Bond, 1998), where lagged differences of the dependent variables are used as instruments in level equations in addition to lagged levels of dependent variables for equations in the first differences and the explanatory variables in difference. The GMM model requires two specification tests: the serial correlation test and the test for over-identification restrictions (Arellano and Bond, 1991). The serial correlation test considers the presence of second-order autocorrelation in the residuals from differenced equations. If the p-value is larger than 0.05, it means that there is no second-order autocorrelation – which is the case in this paper. The null hypothesis for the over-identification restrictions test (the Hansen J test) is that the instrument set is valid. If this test result does not reject the null hypothesis, then the instruments are valid – as they are in our case. The difference-in-Hansen test of exogeneity (Eichenbaum et *al.*1988) is used to test the null hypothesis that the subset of instruments used in the levels equations are exogenous. In this

paper, this null hypothesis is not rejected indicating exogeneity of subsets of instruments used in the system GMM estimates. In sum the GMM estimates are valid.

3.3.1 Model specification

Our model is based on the following dynamic panel data specification:

$$Y_{ijt} = \alpha Y_{ijt-1} + \beta_1 X_{1ijt} + \beta_2 X_{2ijt} + \beta_3 X_{3i} + \mu_i + \varepsilon_{ijt} \quad (02)$$

$$|\alpha| < 1 \quad i = 1,...,N;\ j = 1,...,J \quad t = 1,...,T$$

where the subscripts *i* and *t* denote the cross-sectional and the time dimension of the panel sample respectively, Y_{ijt} is the MF's interest rate in county j in period *t;* X_{1ijt} is the vector internal factors. These factors are a set of MFI-specific control variables in country j at *t* period, these include: Financial costs, Operating costs rate, Loan loss rate, Write off ratio, Women borrowers, Average gross loan portfolios, Profit rate, and Portfolio at risk at 30 days; X_{2ijt} is the vector of external factors defining a set of macroeconomic variables at in country j in *t* period (competition, regulation, inflation and Gini per capita) ; X_{3i}: vector of legal status (UC,ONG, NBFI, RB, BANQ) ; μ_i are the unobserved individual effects and ε_{ijt} is the specific shock of each MFI and on each period with mean zero for all *i* and *t* period $E(\varepsilon_{ijt}) = 0$. The vectors X_{1ijt}, X_{2ijt} could also contain both contemporaneous and lagged values of the internal and external factors respectively.

The estimation procedure commonly used to estimate parameters in Equation (02) in the presence of unobserved individual-specific heterogeneity is to transform the model into first differences and use the difference GMM estimator.

$$\Delta Y_{ijt} = \alpha \Delta Y_{ijt-1} + \beta_1 \Delta X_{1ijt} + \beta_2 \Delta X_{2ijt} + \Delta \varepsilon_{ijt} \quad (03)$$

Δ is the first difference operator. In Equation (2) the lagged dependent variable, ΔYit_{-1} is correlated with the error term, $\Delta \varepsilon_{ijt}$ imposing a bias in the estimation of the model.

Nonetheless, Y_{ijt-2} which is expected to be correlated with Y_{ijt-1} and not correlated with $\Delta \varepsilon_{ijt}$ for $t = 3, \ldots, T$ can be used as an instrument in the estimation of Equation (03) given that ε_{it} are not serially correlated.

We refer to Arellano and Bover (1995), Baltagi, (2021) to present the equation (02) and (03). It circumvents the bias problem of the finite sample if the mild stationarity assumption is

accepted (Baltagi, 2021). The procedure is to estimate a system of equations that combine the equations in first-difference and those in levels. The instruments used in the level's equations are the lagged variables in the first difference of the series.

Arellano, and Bond (1991) argued that the GMM-system estimator performs better than the difference GMM estimator because the instruments in the level model remain good predictors for the endogenous variables when the series is very persistent.

We compute robust two-step standard errors following the methodology proposed by Newey and Windmeijer, (2009). We also test the overall validity of the instruments by implementing the Sargan Hansen specification test (J-test). It is asymptotically distributed as chi-square and this under the null hypothesis of valid moment conditions (Bond, 2002).

3.4 Results and discussions

In this section, we present the different estimations to analyze whether the explanatory variables have a significant impact on the Interest rate of MFI fluctuations or whether this interest rate is defined according to the anticipations phenomena of some variables.

3.4.1 Estimation Results

Table 2 shows the estimation results exhibited through the generalized method of moments considering a database including 3770 observations. Model 1 is the basic model which considers all the variables, models 2 - 7 progressively exclude the non-significant variables to consider only variables that better explain the interest rate variability level. Models 8 and 9 consider the different interactions to compensate for autocorrelation biases (LLR - WOR and OC -PR).

Tableau 2: Estimation results from the GMM-system

Variables Category	Variables	(1) RIR	(2) RIR	(3) RIR	(4) RIR	(5) RIR	(6) RIR	(7) RIR	(8) RIR	(9) RIR
	RIR (-1)	0.336***	0.356***	0.363***	0.336***	0.333***	0.326***	0.356***	0.352***	0.363***
		(0.053)	(0.057)	(0.058)	(0.061)	(0.06)	(0.059)	(0.052)	(0.051)	(0.038)
	FC	0.18*	0.194*	0.19*	0.221**	0.227**	0.23**	0.172*	0.208**	0.176*
		(0.104)	(0.107)	(0.107)	(0.11)	(0.111)	(0.11)	(0.103)	(0.106)	(0.098)
	Δ.FC	0.576***	0.584***	0.592***	0.549***	0.556***	0.551***	0.569***	0.551***	0.605***
		(0.085)	(0.089)	(0.089)	(0.094)	(0.096)	(0.095)	(0.086)	(0.085)	(0.076)
	OC	0.104*	0.10*	0.095*	0.10*	0.10*	0.099*	0.103*	0.115**	0.119**
		(.057)	(.055)	(.055)	(.055)	(.056)	(.055)	(.059)	(.058)	(.057)
	Δ. OC	0.143***	0.136***	0.135***	0.129***	0.135***	0.134***	0.153***	0.143***	0.121***
Internal		(0.035)	(0.037)	(0.037)	(0.037)	(0.038)	(0.037)	(0.036)	(0.037)	(0.032)
Factors	PR	0.001	-0.001	-0.001				-0.021**		-0.022**
		(0.005)	(0.005)	(0.005)				(0.015)		(0.013)
	.PR (-1)	0.003						0.004		
		(0.006)						(0.006)		
	WOR	-0.131						-0.433**	-0.376**	-0.493***
		(0.207)						(0.141)	(0.111)	(0.127)
	Δ.WOR	0.449***	0.47***	0.479***	0.517***	0.531***	0.528***	0.438***	0.443***	0.455***
		(0.066)	(0.066)	(0.067)	(0.071)	(0.071)	(0.07)	(0.066)	(0.068)	(0.066)
	LLR	0.138	0.054	0.037				0.088		0.198*
		(0.162)	(0.074)	(0.076)				(0.127)		(0.112)
	LLR (-1)	0.010						0.001		
		(0.001)						(.001)		
	AD	0.081***	0.074***	0.074***	0.078***	0.077***	0.077***	0.082***	0.077***	0.086***
		(0.021)	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
	WB	0.055*	0.022**	0.023***	0.023**	0.055*	.022**	.057**	.037*	.007*
		(0.007)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.059)	(0.019)	(0.015)
	WB^2	-0.067**	-0.055**	-0.063*	-0.066*	-0.0.59	-0.47**	-0.069**	-0.47**	-0.069**
		(0.057)	(0.053)	(0.056)	(0.037)	(0.043)	(0.036)	(0.05)	(0.036)	(0.05)
	logALS	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.08***
		(0.001)	(.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.02)
	logALS^2	-0.001**	-0.001**	-0.004	-0.006			-0.001*	-0.001*	-0.007***
		(0.001)	(0.001)	(0.001)	(0.001)			(0.001)	(0.001)	(0.001)
	logGLP	-0.006	-0.01**	-0.01**	-0.012**	-0.011**	-0.011**	-0.008	-0.008*	-0.014***
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
	INFL	0.178**	0.15***	0.158**	0.155**	0.152**	0.151**	0.155**	0.146**	0.148***
		(0.047)	(0.026)	(0.026)	(0.026)	(0.027)	(0.027)	(0.03)	(0.028)	(0.025)
	Δ. INFL	-0.023						.019		
External		(0.028)						(.027)		
Factors	COMP	0.003	0.002	0.002	0.003			0.004		0.009***
		(0.003)	(0.003)	(0.003)	(0.003)			(0.003)		(0.003)
	REG	0.012	0.002				0.002			
		(0.201)	(.234)				(.234)			
	logGINI	0.035	0.029	0.031	0.036	0.041*	0.042*	0.046*	0.048*	0.083***
		(0.024)	(0.023)	(0.023)	(0.023)	(0.022)	(0.022)	(0.025)	(0.025)	(0.024)
	logGINI (-1)	-0.035						-0.039	-0.044*	-0.022*
		(0.025)						(0.025)	(0.025)	(0.023)
	BANK	-0.232		-0.254	-0.191	-0.164	-0.152	-0.097	-0.067	
Legal		(0.245)		(0.243)	(0.246)	(0.458)	(0.244)	(0.224)	(0.227)	
Status	CU	0.536	0.465	0.446	0.471	0.46	0.461	0.492	0.622	
(Reference		(0.488)	(0.52)	(0.516)	(0.512)	(0.528)	(0.502)	(0.472)	(0.472)	
= RB)	NBFI	0.307**	0.189	0.237*	0.245*	0.248	0.261**	0.266**	0.271**	
		(.131)	(.124)	(.131)	(.131)	(.203)	(.13)	(.126)	(.128)	
	NGO	0.527***	0.395***	0.43***	0.457***	0.476***	0.486***	0.502***	0.494***	
		(0.141)	(0.137)	(0.14)	(0.139)	(0.141)	(0.14)	(0.132)	(0.133)	
	OTHERS	1.417	0.955	1.276	1.383	1.55	1.522	1.393	1.264	
		(1.019)	(1.013)	(1.048)	(1.04)	(1.065)	(1.028)	(.945)	(.95)	
	LLR* WOR							1.72***	1.78***	1.565***
Interaction								(0.49)	(0.497)	(0.441)
	PR* OE							.106		.106
								(0.081)		(0.077)
	Obs	3770	3770	3770	3770	3770	3770	3770	3770	3770
	AR (1) (P-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	AR (2) test	0.9443	0.9154	0.9487	0.9985	0.973	0.9726	0.9067	0.924	0.9564

(P -value)									
J statistic (Sargan test)	0.4899	0.4967	0.5399	0.5239	0.5078	0.5394	0.5738	0.6032	0.1165
Instruments' Numbers	97	91	89	86	87	86	99	90	95

Note: two-step system GMM (Generalized Method of Moments) ... AR (1) and AR (2) are tests for first and second-order serial correlation in the first-differenced residuals, under the null hypothesis of no serial. The J statistic of over-identification is under the null hypothesis that all instruments are valid.
(*) (**) and (***) denote statistical significance at the 10 percent, 5 percent and 1 percent respectively. L.: mean the lagged variable; Δ: mean de first difference variable.

Instruments for differenced equation GMM-type:

L (2/.). RIR and the Standard: D.FC D2.FC D. OE D2. OE D.WOR D2.WOR D.AD D. logALS LD. LogALS D. logALS D. INFL

D. logGINI/CAPITA LD. LogGINI/CAPITA D. LLRWOR

Instruments for level equation

GMM-type: LD.RIR

3.4 2 The internal factors result

This section examines the long-term relationship between the interest rate and the internal, external and legal status factors.

The variability in the interest rate is due to several factors. Across all the models (1 to 9) highlighted, we find that the coefficient of the lagged interest rate (RIR (-1)) is significant and positive at 1 percent level. This result shows that the Interest rate of MFI rising can be persistent over time and that the anticipation phenomena of the interest rates remain a reality in the microfinance sector. Long-term interest rates are often higher than short-term ones. The money that remains capitalized for a longer time in an uncertain future and the lower risk level in the short term can explain this result. Considering anticipations will enable MFIs to adjust the relationship between the yield and the risk compared to the existing risk portfolios and the various assets. The consequence is that, short-term rising interest rates affect long-term rates more quickly and more often. These results are consistent with reality because the level of the interest rate in period *t* depends on the level of interest rates in the preceding *t-1* period.

Operational (OC), resource costs and these variable differences also admit positive and significant coefficients. The more important these factors are the higher the interest rate increases. Access to the refinancing of microfinance institutions is often expensive from private investors or lenders.

In addition, costs on lending' diversification of activities, recruitment and training of staff, debt collection and the setting up of new agencies. This result may also be explained by the development of MFI, which means that potential lenders tend to reduce their loans and charge higher interest rates on loans. MFIs will increasingly turn to commercial borrowers at high lending rates in national or international financial markets. To compensate for this shortfall, MFIs apply high interest rates compared to those set by traditional banks. The positive impact of the current financial cost value is confirmed by Cotler and Almazan (2013), Cuéllar Fernández (2012), Dorfleitner et *al.* (2013) specify that operating costs (OC) result in higher's interest rates.

Female borrowers (WB) occupied a crucial part in the development of the MFIs and interest rate determinant due to their reactivity and repayment capacity. Therefore, they are a potential target for most MFIs that operating in rural areas. We also observe that an increase in the number of women borrowers up to the 67 percent threshold is accompanied by a real interest rate increase.

This threshold represents the ratio between the marginal effects of the WB and WB^2 variables. If the number of female borrowers is between 0 to 67 percent, the interest rate tends to increase (Models 1 and 9). Beyond this 67 percent level, the effect of this variable on the interest rate is decreasing. This result is similar to that found in substance by some authors who report that the impact of women borrowers on the interest rate might be positive but for an average loan size less than USD 300. Beyond this amount, this influence may be negative because women apply for small loans. Other authors consider MFIs cater to a high proportion of female borrowers because the risk of loan loss is also less important.

Debt write-off rates (WOR), loan size (ALS), deposits (AD), and the current variable of the average loan size also assume positive and significant coefficients at 1 percent. This result shows that the increase in the risk of non-payment and the size of microfinance institutions through deposits and loans leads to an increase in the MFIs' borrowing interest rate. This result can be explained by a drift of the social mission of MFI that consists in granting loans of small amounts

and facing counterparty risk. However, the effect of the average size of loans is not linear because the coefficient associated with this square variable (ALS^2) is negative and significant.

This latter result is partially consistent with those of Dorfleitner et *al.* (2013). This variable reflects the financial sustainability of MFI and the performance level.

In addition to these internal factors which lead to an increase in the interest rate, there are others whose increase is synonymous with a decrease in the interest rate. We can quote among them the profits (PR) which admits negative and significant coefficients to 1 percent level. A certain level of profit may allow the MFI to gain a certain autonomy allowing it to face the risk of non-payment, reach the least favored clientele, and combine the social objective. However, this search for profit should not be considered as an end in itself if the MFI does not consider the social objective.

3.4 3 The external factors result

External factors include the market's structure (competition), economic growth (Gini per capita, inflation) and banking regulations. Among the most important macroeconomic factors determining the variability of MFI borrowing interest rates, we noted the current inflation and Gini per capita.

Inflation can cause significant difficulty in the development of MFI. In the context of inflation rising, MFIs are often faced with an arbitration problem between a negative real interest rate that would negatively affect their loan portfolio quality because customers would save less and a nominal interest rate that covers inflation. In the first case, the objective of the MFI consists to of boosting households' dwindling purchasing power. In the second case, the interest rate increase aims to hold inflation at a reasonable level. This would mechanically increase a household's purchasing power by emphasizing the income increasing.

The results in Table 2 show a positive and significant relationship at the 1 percent level between current inflation and the interest rate level. However, the relationship between this latter and the inflation rate variations in two periods (Δ. INFL) isn't significant. These results show that MFIs don't anticipate inflation in their interest rate setting.

In addition to inflation, the Gini per capita variable also assumes positive and significant coefficients at a 1 percent level. In other words, the interest rate increases with country development. This latter is associated with a poverty level decrease.

The results also show that the coefficients associated with REG are positive but not significant. This result shows that regulation does not necessarily reduce interest rates even if a regulated MFI is more likely to lower its interest rates. This non-significant impact of regulation on Interest rate of MFI may result from the restraint measures introduced by the government such as the interest rate ceiling, supervision or control, the requirement to hold minimum reserves, and restrictions on providing certain financial services that involve additional costs for the MFI.

However, regulation can also cause a transition from a non-profit MFI to a for-profit MFI and force some of MFIs to adopt joint-stock company status to obtain a license. Our results seem to be at odds with those of Hartarska et *al*. (2013) who have shown that regulation leads to lower interest rates.

In the microfinance sector, competition (COMP) can be considered as an important innovation driver. Based on the results in Table 2, we remark that the competition (COMP) impact is not significant. However, all coefficients associated with this variable are positives. This phenomenon can be justified by the necessity for MFIs to provide quality services and facilitate access to loans to get closer to and maintain their target groups. This may increase the operating factors. Assefa et *al.* (2013) show that intense competition adversely affects considerably the performance of the MFI.

3.5 Analysis of the legal status effect

Table 3 shows the interest rate variation according to the legal status of MFI. From this table and for each MFI type, we notice that the interest rate in *t* period is defined according to that of in *t-1* period. The coefficients associated with this variable and according to each legal status, excepted, are positives and significant at 1 percent level. Otherwise, NGO, NBFI, RB and BANK generally anticipate increasing interest rates. This anticipation phenomenon is more important in CU.

The results in this table demonstrate that the effect of FC on the interest rate determination is positive for all legal statuses. It is greater for RB and CU with significant coefficients at the 1 percent level. As for OC, their impact on the interest rate increase is greater for BANK, NBFI with positive and significant coefficients at the 1 percent level.

This can be explained by the individual lending provided by these MFI types. For example, CU makes group loans, which is a solution that minimize cost.

Baquero et *al*. (2018) found that BANK applied a higher interest rate. Analysis of other variables like WB, REG, and ALS provides different results according to the legal status. We observe a negative and significant impact of regulation on interest rate change for NBFI. This result proves that there is a difference in interest rate between regulated and unregulated BANK, CU, and NGO.

For WB, the positive expected signs of the coefficients are obtained for all MFIs types except NGO. However, they remain non-significant for most of them. For an NGO a 1 percent increase in female borrowers generates a negative and significant interest rate fluctuation. The same pattern is noted for the PR with negatives and significant coefficients for BANK, CU and RB and positives coefficients NGO and NBFI. The impact of PR on the interest rate is greater for BANK, RB and NGO.

As for the current write-off ratio (WOR), it has a negative and significant effect on interest rate considering all the legal status. According to the first difference estimation of this variable, all the coefficients are positives.

Generally, the pattern provided by the estimates in Table 3 show that CU and NGO have more varied interest rates. To confirm these results, we use the Fisher test.

Tableau 3: Interest rate determinant according to legal status

Variables category	Variables	(1) BANK	(2) CU	(3) NBFI	(4) NGO	(5) RB
	RIR (-1)	0.362***	0.612***	0.232***	0.409***	0.248**
		(0.024)	(0.05)	(0.039)	(0.055)	(0.124)
	FC	0.353***	0.754***	0.43***	0.346***	1.225***
		(0.106)	(0.057)	(0.094)	(0.112)	(0.36)
Internal factors	Δ.FC	0.681***	1.096***	0.348***	0.692***	
		(0.066)	(0.043)	(0.072)	(0.085)	
	OC	0.277***	0.183***	0.214***	0.10	-.177
		(0.065)	(0.033)	(0.062)	(0.064)	(0.112)
	Δ. OC	0.157***	0.609***	0.151***	0.094**	
		(0.025)	(0.039)	(0.026)	(0.039)	
	PR	-0.036***	-0.01*	0.005	0.03***	-0.034**
		(0.01)	(0.005)	(0.019)	(0.011)	(0.016)
	WOR	-0.737**	-0.697**	-0.28*	-0.546***	-0.153*
		(0.371)	(0.321)	(0.166)	(0.198)	(1.101)
	Δ.WOR	0.996***	0.712***	0.198***	0.617***	
		(0.103)	(0.114)	(0.053)	(0.068)	

	LLR	0.244	-0.58	0.215**	0.04	0.046
		(0.423)	(0.354)	(0.107)	(0.196)	(0.828)
	AD	0.049***	0.105***	0.13***	0.123***	0.07
		(0.01)	(0.014)	(0.035)	(0.044)	(0.069)
	WB	0.148	-0.048	0.11	-0.176***	0.024
		(0.131)	(0.049)	(0.071)	(0.065)	(0.047)
	WB^2	-0.137	-0.012	-0.021	0.156***	
		(0.134)	(0.046)	(0.056)	(0.056)	
	logALS	-0.117***	0.114***	0.087***	0.061***	-0.508*
		(0.03)	(0.024)	(0.024)	(0.023)	(0.299)
	logALS^2	0.006***	-0.007***	-0.009***	-0.005***	0.036
		(.002)	(.002)	(.002)	(.002)	(.025)
	logGLP	0.001	-0.016***	0.007	-0.031***	0.016
		(0.005)	(0.004)	(0.005)	(0.005)	(0.024)
External factors	INFL	0.027	-0.034	0.046**	0.266***	0.476***
		(0.034)	(0.029)	(0.021)	(0.036)	(0.182)
	COMP	0.008*	0.002	0.001	-0.001	-0.173
		(0.005)	(0.002)	(0.003)	(0.004)	(0.186)
	REG	0.481***	0.117**	-0.055	0.073**	0.951
		(0.11)	(0.059)	(0.061)	(0.035)	(0.693)
	logGINI	0.104***	0.007	0.061**	0.121***	0.142
		(0.017)	(0.023)	(0.026)	(0.028)	(0.159)
	logGINI (-1)	-0.073***	-0.053***	-0.094***	0.028	
		(0.028)	(0.019)	(0.022)	(0.026)	
Interactions	LLR*WOR	1.661***	24.44***	1.877***	1.759***	
		(0.547)	(4.491)	(0.495)	(0.166)	
	PR*OC	0.413***	0.016	-0.113	-0.098**	
		(0.035)	(0.041)	(0.103)	(0.05)	
	Observations	385	390	1516	1367	112
	AR (1) test (P-value)	0.000	0.0128	0.000	0.0000	0.212
	AR (2) test (P-value)	0.956	0.3360	0.9978	0.0935	0.402
	J-Statistic (Sargan test)	0.1165	0.6604	0.2869	0.1129	0.999
	Instruments' Numbers	87	79	96	93	60

Note: The variables are defined in table 19.3

Estimation: two-step system GMM (Generalized Method of Moments). AR (1) and AR (2) are tests for first and second-order serial correlation in the first-differenced residuals, under the null hypothesis of no serial. The J statistic of over-identification is under the null hypothesis that all instruments are valid. (*) (**) and (***) denote statistical significance at the 10 percent, 5 percent and 1 percent respectively. Standard errors are in parentheses. L.: mean the lagged variable; D.: mean de first difference variable.

Instruments for differenced equation GMM-type :

L (2/.). RIR and the Standard : D.FC D2.FC D. OE D2. OE D.WOR D2.WOR D.AD D. logALS LD. LogALS D. logALS D. INFL

D. logGINI/CAPITA LD. LogGINI/CAPITA D. LLRWOR. Instruments for level equation. GMM-type : LD.RIR

3.5 1 Analysis of the legal status effect according to the Fisher test

The results from the estimates in Table 2 and 3 shows how the different factors considered affect the Interest rate of MFI. Nevertheless, despite the relevance of these results, they don't

specifically prove how these variables affect the interest rates according to each legal status. These include NGO, NBFI, RB, CU and BANK. Differences across legal status are likely to lead to differences in strategies and objectives pursued by MFIs.

In the literature, some authors (Tchakoute-Tchuigoua, 2012; Nwachukwu et *al*.2018; Hermes et *al*.2018) have developed the influence of the legal status on interest rate changes. Unfortunately, in the literature, no statistical test has ever been carried out to highlight the influence of the legal status on interest rates. To fill this gap, we propose to perform Fisher's statistical test. We present an econometric model that considers the dynamic panel data models and use the F-test statistic, which provides better results for these kinds of qualitatives variables.

We consider the restrictions which provide the restricted model of no legal status effects:

$$H_0: \beta_3 = 0 \quad (04)$$

This one can be written like this

$$H_0 : \beta_3(\ CU) = \beta_3(BANK) = \beta_3(RB) = \beta_3(NGO) = 0 \quad (05)$$

which is a null hypothesis of the linear combination of the 4 regression coefficients. To test this null hypothesis, firstly we write the corresponding econometric restricted model:

$$Y_{ijt} = \alpha Y_{ijt}-1 + \beta_1 X_{1ijt} + \beta_2 X_{2ijt} + \mu_i + \varepsilon_{ijt} \quad (06)$$

Secondly, the F-test for legal status effects is based on the statistic:

$$F = \frac{(RSS_R - RSS_U)/4}{RSS_U/N(T-1)-k} \sim F_{4,N(T-1)-k} \quad (07)$$

RSS_R is the restricted sum of squares (from the regression of the restricted model) and RSS_U is the unrestricted sum of squares, from the regression of the model (02), 4 is the number of restrictions, *N* is the number of observations, T is the number of periods and *k* is the number of regression coefficients. This statistic follows a Fisher distribution at 4 and *N (T-1)-k* degrees of freedom.

The Fisher's test in table 4 confirms that the interest rate differs from institution type and validates the hypothesis that Interest rate of MFIs also depend on the legal status.

Tableau 4 : Results of the Fisher test for legal status

Legal status effect on interest rate according to the Fisher test					
	Model 1 RIR	**Model 2 RIR**	**Model 3 RIR**	**Model 4 RIR**	**Model 5 RIR**
F-test	23.645236***	27.806439***	30.856026***	24.224142***	40.781991***

Note: *** = significant at 1 percent, ** = significant at 5 percent, * = significant at 10 percent.

3.6 Conclusion

The objective of this paper has been to identify the decisive factors of MFI interest rate fluctuations in a dynamic framework to complement the analyses proposed by Dorfleitner et *al*. (2013). We have focused in this paper on a dynamic panel analysis to understand MFI behavior in setting interest rates. Thus, it explains that interest rates are derived from the anticipations of certain parameters. MFIs anticipate these interest rate changes because they are sensitive to the slightest economic variations. A slight difference in the FC, OC, WOR and ALS between two periods has a significant impact on the Interest rate of MFI.

We find that factors such as gender (number of female borrowers), legal status, and regulation also contribute to the Interest rate of MFI variation. Also, Pitt and Khandker (1998) conclude that there is an ambiguous relationship between women borrowers and interest rates.

We have also explained in this paper that there is a threshold effect in the relationship between WB and the interest rate. In other words, women pay higher interest rates if they make up less than 67 percent of the institution's borrowers and lower interest rates above this threshold. In terms of the institution's legal status, we have demonstrated that CU and NGO clients face higher interest rates than clients of other MFIs types.

Another important finding in this paper is that MFIs do not anticipate inflation, instead, they incorporate current inflation in defining interest rates, which is a recurring phenomenon in developing countries. This paper contributes to the field because the results are widespread in all MFIs worldwide with a representative sample size (3770 observations) and relevant variables.

The methodological approach (dynamic method) used in this paper is a first in the literature of microfinance institutions. Nevertheless, despite these important conclusions, some limitations are worth noting. The data collected from the five geographical regions show different characteristics that may generate selection bias. This paper might be enhanced by distinguishing between regulated and unregulated MFIs. Research on borrowers could also be extended because their attitude changes with interest rate variations.

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