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Subject: The Determinants of Small and Medium-Sized Enterprise Financing in Madagascar : A Theoretical and ARDL Analysis

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Abstract - This article examines the determinants of SME financing in Madagascar by combining a theoretical review and an ARDL econometric analysis. It starts from the observation that SMEs play an essential role in employment and growth, but remain constrained by a lack of collateral, information asymmetry, and weak accounting information. The literature review draws on four main frameworks: trade-off theory, pecking order theory, agency theory, and life cycle theory, in order to explain financing choices and difficulties in accessing credit. Methodologically, the study uses an ARDL model to analyze short- and long-term relationships between domestic credit, investment, interest rate, value added, and other macroeconomic variables. Unit root tests show that the series are integrated of order one, which allows for model estimation. The Granger causality test indicates causality running from credit to investment, while the reverse is not confirmed. The selected ARDL model is overall significant, with strong explanatory power, and cointegration tests confirm the existence of a long-term relationship between the variables. Short-term results show a rapid adjustment mechanism toward equilibrium, and robustness tests validate the model's stability and statistical quality. The article concludes that access to credit remains a central lever for SME financing in Madagascar, and that its improvement requires more favorable conditions, both at the banking and institutional levels.

Keys Word : SMEs, Growth, Financing, Asymmetry, Credit

1.INTRODUCTION

The study of small and medium-sized enterprise (SME) financing is a major issue for economic analysis, particularly in developing countries where these productive units play an essential role in job creation, revitalizing the entrepreneurial fabric, and stimulating growth. Yet, despite their importance, SMEs often face significant difficulties in accessing financial resources, notably due to a lack of collateral, insufficient reliable accounting information, and the high risk perception by financial institutions[1].

[1] MAMIARISOA Jean Edith Françoise, RADIMILAHY Manana Asidy, MBIMA Césaire, BELA Chrétien : « ATTITUDE DES ENTREPRENEURS FACE AU FINANCEMENT DE CYCLE D'EXPLOITATION DES PETITES ET MOYENNES ENTREPRISES A MADAGASCAR » Revue International Scientifique, 2024.

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In this context, the theoretical literature has proposed several approaches to shed light on SMEs' financing choices and the obstacles they encounter. Among the most widely used are trade-off theory, pecking order theory, agency theory, and information asymmetry. These approaches highlight the trade-offs between debt and equity, firms' preference for internal resources, as well as potential conflicts between managers, owners, and creditors[2].

Moreover, understanding SME financing cannot be complete without taking into account the temporal dynamics of the economic variables that influence credit supply and demand. For this reason, the econometric analysis here uses an ARDL model, which is particularly suited to studying short- and long-term relationships between several macroeconomic series[3].

Thus, this study presents the main theoretical foundations of SME financing, before outlining the methodological approach adopted to analyze, in the case of Madagascar, the determinants of credit and their effect on business financing.

2.THEORETICAL LITERATURE REVIEW

The financing of small and medium-sized enterprises (SMEs) occupies a central place in economic analysis, as these productive units are an important source of job creation, innovation, and growth. However, their access to financial resources often remains limited, which has led the literature to develop several theoretical frameworks to explain their financing choices and the obstacles they face. Studies devoted to SMEs generally emphasize their structural particularities: small size, dependence on the owner-manager, lack of collateral, high sensitivity to transaction costs, and imperfect financial information.

The first important approach is the trade-off theory. This theory posits that a firm seeks an optimal financing structure by balancing the benefits and costs of debt. On the one hand, debt provides a tax advantage due to the deductibility of interest; on the other hand, it increases the risk of bankruptcy and financial distress costs. Applied to SMEs, this theory assumes that a reasonable level of debt may be desirable if the expected gains offset the risks incurred. However, several authors point out that this approach is often less suited to SMEs than to large firms, since SMEs rarely have stable access to financial markets and bear the costs of credit more heavily[4].

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[2] Philippe Adair and Mohamed Adaskou : « Théories financières et endettement des PME en France Une analyse en panel », Université Paris-Est, Revue International du PME, Erudie, 2024

[3]IAICH El Mestapha Hamid, BOURAOUANE Badr : « Investissement public et croissance économique au Maroc : approche par modèle ARDL » Maroc, 2020

[4] Philippe Adair and Mohamed Adaskou : « Théories financières et endettement des PME en France Une analyse en panel », Université Paris-Est, Revue International du PME, Erudie, 2024

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The pecking order theory, or financing hierarchy theory, constitutes another major framework. Developed from the work of Myers and Majluf, it argues that firms prefer to finance their activities in a specific order: first internal funds, then debt, and, as a last resort, external equity contributions. This hierarchy is explained by information asymmetry between managers and external financiers. In the case of SMEs, this theory is particularly relevant because these firms often have incomplete accounting information, low transparency, and limited financial credibility. They therefore turn primarily to self-financing, trade credit, or bank borrowing, while equity financing remains rare.

Agency theory provides a useful complement to this analysis. It highlights potential conflicts of interest between owners, managers, and creditors. In an SME, these conflicts may take the form of inefficient use of resources, a preference for personal projects, or a risk of adverse selection by lenders. Banks, faced with this risk, often demand collateral, reliable financial statements, and a track record of profitability. Yet these requirements constitute precisely major obstacles for small businesses. Agency theory therefore helps explain why credit rationing affects SMEs more than large firms.[5]

Information asymmetry also plays a central role in SMEs' financing difficulties. External financiers rarely have complete information on project quality, the competence of the manager, or the long-term viability of the business. This uncertainty increases the risk perceived by financial institutions and leads either to a higher cost of credit or to an outright refusal of financing. In this context, the problem is not only the scarcity of capital, but also the market's inability to distinguish good projects from bad ones. SMEs are therefore often confronted with financial rationing even when their demand for credit is economically justified.

Other theoretical approaches further enrich the understanding of SME financing. The life cycle theory of the firm emphasizes that financing needs evolve according to the age and development stage of the firm. A young SME depends more on equity, family support, or microfinance, while a more mature firm can access bank credit or more sophisticated instruments such as leasing or private equity more easily. This perspective is important because it shows that financing difficulties are not identical at all stages of a firm's life[6].

Finally, recent literature emphasizes alternative financing solutions, notably microfinance, private equity, guarantee funds, and public support mechanisms. These mechanisms aim to correct failures in the credit market, especially for the smallest or riskiest firms. In developing economies, where financial markets are shallow, these instruments play an even more important role as they can compensate for the inadequacy of traditional banks and promote the financial inclusion of SMEs.

[5] Philippe Adair and Mohamed Adaskou : « Théories financières et endettement des PME en FranceUne analyse en panel », Université Paris-Est, Revue International du PME, Erudie, 2024
[6] FILALI Oumayma, TORRA Mohamed: « CAPITAL-INVESTISSEMENT ET FINANCEMENT DE PME INNOVANTES : UNE REVUE DE LA LITTÉRATURE » Revue du Contrôle de la Comptabilité et de l'Audit, 2023

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In short, the theoretical literature shows that SME financing cannot be explained by a single theory. The trade-off approach emphasizes the balance between the advantages and costs of debt, the pecking order highlights the preference for internal resources, while agency theory and information asymmetry explain restrictions on access to credit. Together, these approaches help to understand why SMEs remain structurally confronted with financing difficulties, despite their strategic role in economic development.

3. METHODOLOGY

The ARDL "AutoRegressive Distributed Lag / ARDL" model is a combination of autoregressive AR models (models in which the explanatory variables include past values of the dependent variable) and distributed lag DL models (models that have as explanatory variables: Xt and its past values). Thus, to study financing through credit in Madagascar, we will estimate the ARDL (AutoRegressive Distributed Lag) model. This model, which belongs to the class of dynamic models, makes it possible to capture temporal effects. We therefore consider an endogenous variable (Yt) that can be explained by:

Its own past values (Y_{t-i}), this is called an autoregressive (AR) model and can be written as

$$Y_t = a_0 + a_1 Y_{t-1} + \ldots + a_p Y_{t-p} + \varepsilon_t$$

or

$$Y_t = a_0 + \sum_{i=1}^{p} a_i Y_{t-i} + \varepsilon_t \ldots \quad (1)$$

$\mathcal{E}_t \sim idd\ (0,\ \sigma)$: error term.

In addition to the exogenous variables (X_t) and their past values (X_{t-i}), we are referring here to distributed lag (LD) models, which take the following form:

$$Y_t = \beta_{\square} + b_0 X_t + \ldots + b_q X_{t-q} + z_t$$

or

$$Y_t = \beta + \sum_{i=0}^{q} b_i X_{t-i} + z_t \ldots \quad (2)$$

Indeed, the combination of the two models gives what is called the ARLD model (autoregressive models with staggered or distributed lags), and its form is written as follows:

$$Y_t = \phi + a_1 Y_{t-1} + \ldots + a_p Y_{t-p} + b_0 X_t + \ldots + b_q X_{t-q} + e_t$$

where Y_t , X_t , and εt are respectively the endogenous variable, the exogenous variable, and the error term.

4. Results

4.1 Presentation of credit provided to the private sector in Madagascar

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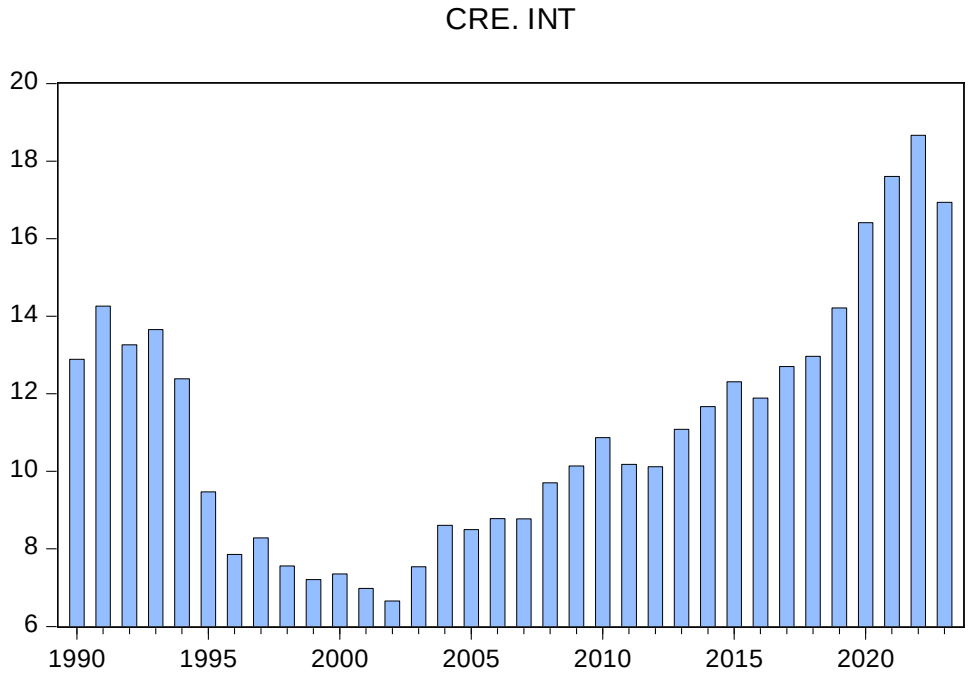
This graph shows the trend in Domestic Credit to the private sector (CRE. INT) in Madagascar, expressed as a percentage of GDP, over the period from 1990 to 2023.

Graph 01: Credit provided to the private sector by the Bank



This graph shows the trend in Domestic Credit to the private sector (CRE. INT) in Madagascar, expressed as a percentage of GDP, over the period from 1990 to 2023. This trend can be broken down into three distinct phases:

- **1990 - 2002: The decline phase** – After a relative peak in the early 1990s (around 14%), credit to the private sector fell steadily to reach its historic low in 2002, standing at less than 7% of GDP.
- **2003 - 2018: A slow and fragile recovery** – A gradual but irregular upturn is observed. The ratio crossed the 10% threshold again around 2010, before stagnating slightly and then resuming steady growth.
- **2019 - 2023: A notable acceleration** – The end of the period shows much faster growth, reaching a peak of nearly 19% in 2022, before a slight correction in 2023.

4.2. Econometric study: Determinants of credit from financial and non-financial institutions

a. Results for the long-term dynamics (ARDL Model (4, 4, 4, 3, 4) [equation 5])

This result shows the adjustment dynamics of the long-term relationship between variables in the table below.

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Thus, regarding the software procedure, in EViews 10, click on “Quick / Equation Estimation / ARDL – Auto-Regressive Distributed Lag Models”, and we obtain the estimation results.

Table IV: Results for the long-term dynamics, ARDL model (4, 4, 4, 3, 4)

Dependent Variable: CRE__INT
Method: ARDL
Date: 02/15/10 Time: 00:13
Sample (adjusted): 1994 2023
Included observations: 30 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): FBCF INT N__E_SE VAL__AJ
Fixed regressors: C
Number of models evalulated: 2500
Selected Model: ARDL(4, 4, 4, 3, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CRE__INT(-1)	1.109538	0.200293	5.539569	0.0015
CRE__INT(-2)	0.192504	0.339650	0.566771	0.5914
CRE__INT(-3)	-1.283180	0.297829	-4.308441	0.0050
CRE__INT(-4)	-0.513007	0.192122	-2.670213	0.0370
FBCF	-0.339970	0.153592	-2.213456	0.0688
FBCF(-1)	-0.644094	0.184219	-3.496345	0.0129
FBCF(-2)	-1.060550	0.236941	-4.476010	0.0042
FBCF(-3)	-1.178021	0.183222	-6.429480	0.0007
FBCF(-4)	-0.119161	0.099203	-1.201187	0.2749
INT	-0.056258	0.060538	-0.929303	0.3886
INT(-1)	0.082854	0.064557	1.283426	0.2467
INT(-2)	-0.144794	0.080545	-1.797688	0.1223
INT(-3)	-0.008286	0.085692	-0.096693	0.9261
INT(-4)	0.267185	0.064209	4.161202	0.0059
N__E_SE	0.003128	0.002082	1.502214	0.1837
N__E_SE(-1)	0.007961	0.002093	3.802957	0.0089
N__E_SE(-2)	0.012608	0.002316	5.443446	0.0016
N__E_SE(-3)	0.009572	0.002021	4.735848	0.0032
VAL__AJ	0.063378	0.111320	0.569331	0.5898
VAL__AJ(-1)	-0.132523	0.117184	-1.130894	0.3013
VAL__AJ(-2)	-0.018368	0.117597	-0.156193	0.8810
VAL__AJ(-3)	0.681735	0.125586	5.428446	0.0016
VAL__AJ(-4)	0.368847	0.137833	2.676045	0.0367
C	-4.124162	1.216096	-3.391312	0.0147

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R-squared	0.996514	Mean dependent var	10.78099
Adjusted R-squared	0.983151	S.D. dependent var	3.318755
S.E. of regression	0.430781	Akaike info criterion	1.144127
Sum squared resid	1.113432	Schwarz criterion	2.265084
Log likelihood	6.838102	Hannan-Quinn criter.	1.502731
F-statistic	74.57471	Durbin-Watson stat	2.180544
Prob(F-statistic)	**0.000013**		

Source: *Author's calculations using EViews 10 software, 2024*

The coefficients of determination (R-squared), R^2=0.996514 (99% of credit is explained by the exogenous variables retained in the analysis), the result indicates that the model is overall significant since the Prob(F-statistic) is less than 0.05. As for the standard tests relating to the robustness of the model, they show that the model is indeed robust.
Regarding the long-term stability of the obtained model, the bounds cointegration test stipulates that this same model is stable in the long run. This cointegration model test requires that the ARDL model be estimated using the following EViews 10 procedure: View/Coefficient Diagnostics / ARDL Long Run Form and Bounds Test.

Table V: Bounds test for the model

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	**7.823370**	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: *Author's calculations using EViews 10 software, 2024*

The figures displayed from the bounds cointegration test (Table V) show that the calculated Fisher statistic value (7.823370) is strictly greater than the critical Fisher value of the upper bound for all significance levels. Therefore, we reject the H0 hypothesis (absence of a long-term relationship). This confirms a long-term relationship between the explanatory variables and the dependent variable.

b. Results for the short-term dynamics, Model: ARDL(4, 4, 4, 3, 4) [equation 5]
The adjustment dynamics of the short-term relationship: (Short run) are estimated in the table below.

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Table VI: Results for the short-term dynamics

ARDL Error Correction Regression
Dependent Variable: D(CRE__INT)
Selected Model: ARDL(4, 4, 4, 3, 4)
Case 2: Restricted Constant and No Trend
Date: 02/15/10 Time: 00:16
Sample: 1990 2023
Included observations: 30

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CRE__INT(-1))	1.603683	0.185106	8.663596	0.0001
D(CRE__INT(-2))	1.796187	0.204445	8.785653	0.0001
D(CRE__INT(-3))	0.513007	0.115681	4.434687	0.0044
D(FBCF)	-0.339970	0.078194	-4.347789	0.0048
D(FBCF(-1))	2.357732	0.250343	9.417996	0.0001
D(FBCF(-2))	1.297182	0.138436	9.370239	0.0001
D(FBCF(-3))	0.119161	0.035623	3.345032	0.0155
D(INT)	-0.056258	0.025478	-2.208067	0.0693
D(INT(-1))	-0.114105	0.034099	-3.346330	0.0155
D(INT(-2))	-0.258900	0.039410	-6.569415	0.0006
D(INT(-3))	-0.267185	0.044147	-6.052202	0.0009
D(N__E_SE)	0.003128	0.000937	3.339876	0.0156
D(N__E_SE(-1))	-0.022180	0.002400	-9.242451	0.0001
D(N__E_SE(-2))	-0.009572	0.001119	-8.557296	0.0001
D(VAL__AJ)	0.063378	0.033774	1.876511	0.1097
D(VAL__AJ(-1))	-1.032213	0.119592	-8.631158	0.0001
D(VAL__AJ(-2))	-1.050581	0.107489	-9.773892	0.0001
D(VAL__AJ(-3))	-0.368847	0.067781	-5.441749	0.0016
E.C(-1)*	-1.494146	0.161064	-9.276695	0.0001

R-squared	0.965279	Mean dependent var	0.109510
Adjusted R-squared	0.908463	S.D. dependent var	1.051569
S.E. of regression	0.318153	Akaike info criterion	0.810793
Sum squared resid	1.113432	Schwarz criterion	1.698218
Log likelihood	6.838102	Hannan-Quinn criter.	1.094688
Durbin-Watson stat	2.180544		
Prob(F-statistic)	**0.000000**		

Avec EC = CRE__INT - (-2.2366*FBCF + 0.0942*INT + 0.0223*N__E_SE + 0.6446 *VAL__AJ -2.7602)

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Source: Author using EViews 10 software, 2024

The short-term estimation results are presented in the table … The coefficient of the error correction term (EC (-1)*) is negative and significant as expected. When CRE.INT is far from its equilibrium level, it adjusts by nearly 149% in the first period (year).
What is important to note is that, in both the short and long term, SME financing has a significant and strongly positive influence on bank credit.

c. Robustness tests of the ARDL Model (4, 4, 4, 3, 4)

After presenting the model results in the previous step, we will verify the three main assumptions, namely, the normality of errors assumption, the heteroskedasticity test, the error autocorrelation test, and the model coefficient stability test, so that the model remains overall significant.
(In EViews, click View → Residual Diagnostics → (1) Histogram-Normality test – (2) Serial Correlation LM test – (3) Heteroskedasticity test).
The results of the validation test for the ARDL model (4, 4, 4, 3, 4) confirm the validity of our estimated model. The probabilities for the four tests, presented in Table VII below, are greater than 5%. This allows us to accept the H0 hypothesis for each test. The errors of our ARDL model (4, 4, 4, 3, 4) are not autocorrelated, and are also normally distributed. Their variance is constant and our model is well specified.

Table VII: Robustness tests of the ARDL Model (4, 4, 4, 3, 4)

Assumption	**Applied testing**	**Test result**	**Decision**
Normality	Jarque-Bera	Probability=0.330898	Ho accepted
Autocorrelation	Breusch-Godfrey	Probability=0.2892	Ho accepted
Heteroscedasticity	Breusch-Pagan-Godfrey	Probability=0.5068	Ho accepted

Source: Author using EViews 10 software, 2024

Regarding the evaluation of the stability of the estimated ARDL model (4, 4, 4, 3, 4) (In EViews, click View → Stability Diagnostics → Recursive Estimates → CUSUM Test), the results show that the long-term relationship is specifically stable with the CUSUM test. The various model validation tests proved to be conclusive. The various model validation tests proved to be conclusive.
Regarding the evaluation of the stability of the estimated model, with the CUSUM test and the CUSUMQ test, the result from EViews shows a curve contained within a corridor.

Graph No. 02. CUSUM test and CUSUMQ test - ARDL Model (4, 4, 4, 3, 4)

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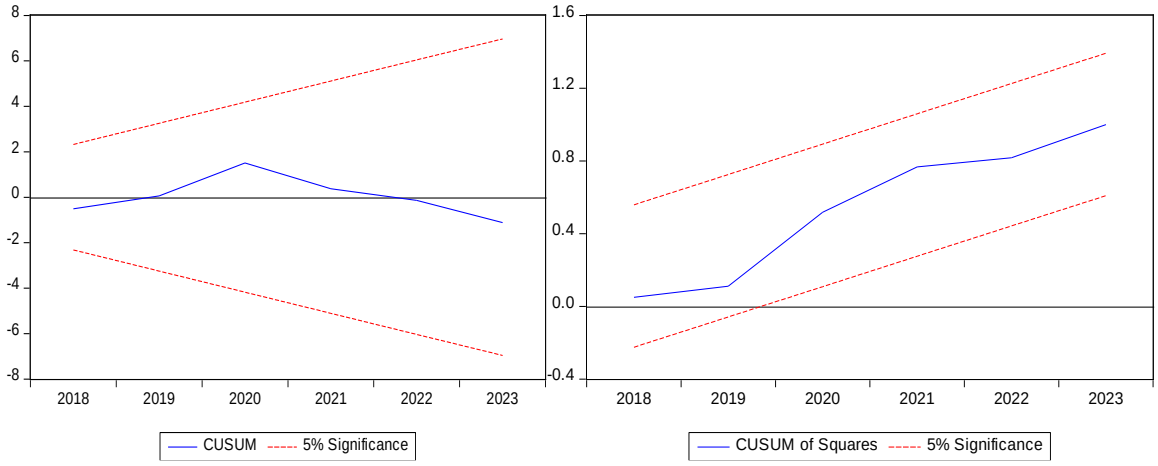

Source: Author using EViews 10 software, 2024

We can conclude that the ARDL model (4, 4, 4, 3, 4) is structurally stable.

5. Conclusion

Ultimately, the theoretical and methodological analysis of SME financing highlights the decisive role of credit in business development and, more broadly, in economic growth. The literature review showed that SMEs still face multiple constraints in accessing financing, related in particular to information asymmetry, lack of collateral, high credit costs, and rationing imposed by financial institutions. The main theories used — trade-off, pecking order, agency theory, and life cycle — provide a better understanding of firms' financing behavior as well as the limitations of traditional financial channels.

On the empirical level, the use of the ARDL model appears particularly relevant for studying the short- and long-term relationships between credit, investment, and the selected macroeconomic variables. The expected results of this approach thus provide a solid basis for identifying the determinants of SME financing in Madagascar and assessing the dynamics of credit over time.

Overall, this section emphasizes that improving access to financing remains an essential condition for strengthening SMEs' investment capacity, supporting their growth, and promoting more inclusive economic development.

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