

Macroeconomic Determinants of Household Credit Risk: Evidence from Non-Performing Loans in Morocco

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ABSTRACT

This study examines the impact of macroeconomic determinants on household non-performing loans (NPLs) in Morocco over the period 2005–2024. Its primary objective is to identify the macroeconomic factors influencing the evolution of household credit risk by employing the Autoregressive Distributed Lag (ARDL) modeling approach. The explanatory variables include economic growth, unemployment rate, lending interest rate, inflation rate, and household debt ratio, while the household non-performing loan ratio serves as the dependent variable. Following the assessment of the stationarity properties of the variables using the Augmented Dickey–Fuller (ADF) unit root test, the ARDL model is estimated. Subsequently, the Pesaran, Shin, and Smith (2001) Bounds Test confirms the existence of a long-run relationship among the variables.

The empirical findings reveal that economic growth significantly reduces household non-performing loans, whereas the lending interest rate exerts a positive effect on household credit default risk. The unemployment rate exhibits a lagged effect, while inflation is found to have a negative impact, contrary to theoretical expectations. Conversely, the household debt ratio does not appear to have a statistically significant effect.

Overall, these findings highlight the crucial role of macroeconomic conditions in shaping household credit risk and provide valuable insights for monetary authorities, financial regulators, and banking institutions in designing effective strategies to mitigate the accumulation of household non-performing loans and preserve financial stability.

Keywords: Household Non-Performing Loans (NPLs); Credit Risk; Households; Macroeconomic Determinants; Autoregressive Distributed Lag (ARDL).

JEL Classification : C22 ; E44 ; G21.

INTRODUCTION

Bank credit plays a fundamental role in economic development by facilitating households' access to financial resources needed to finance consumption, housing acquisition, and various investment projects. By stimulating domestic demand, it contributes to economic growth and social welfare. However, the expansion of bank lending is accompanied by a potential increase in credit default risk, which may undermine the financial stability of banking institutions and, more broadly, the stability of the financial system. Consequently, non-performing loans (NPLs) constitute a key indicator of credit portfolio quality and represent a major concern for banking supervisory authorities.

Over the past decades, economic crises, fluctuations in economic growth, rising unemployment, inflationary pressures, and changes in monetary policy have substantially altered the macroeconomic environment in which households operate. These developments directly affect households' ability to meet their financial obligations and partly explain fluctuations in the level of non-performing loans. In this context, identifying the macroeconomic determinants of household credit risk has become a crucial issue for commercial banks,

monetary authorities, and policymakers due to its implications for financial stability and the effectiveness of prudential policies.

The economic literature highlights a close relationship between non-performing loans and several macroeconomic variables, including economic growth, unemployment, inflation, lending interest rates, and household indebtedness. However, empirical evidence remains inconclusive, with findings varying across countries, study periods, and econometric methodologies. Furthermore, empirical research focusing on Morocco remains relatively limited, particularly studies specifically examining household non-performing loans through a dynamic framework capable of distinguishing between short-run and long-run effects.

Against this backdrop, the present study aims to investigate the impact of the main macroeconomic determinants on the evolution of household non-performing loans in Morocco over the period 2005–2024. To capture the dynamic relationships among the variables, the study employs the Autoregressive Distributed Lag (ARDL) model proposed by Pesaran, Shin, and Smith (2001), which is particularly suitable for small samples and variables integrated of mixed orders, $I(0)$ and $I(1)$. This methodology makes it possible to estimate both the short-run and long-run effects of macroeconomic variables on household credit risk within a unified econometric framework.

The contribution of this study lies in providing a deeper understanding of the macroeconomic mechanisms affecting the quality of household loan portfolios in Morocco. The findings are expected to provide valuable insights for commercial banks, Bank Al-Maghrib, financial regulators, and public policymakers in designing more effective credit risk management strategies, strengthening prudential supervision, and preserving financial stability.

LITERATURE REVIEW

Credit risk is one of the most significant risks faced by banking institutions due to its direct impact on profitability, solvency, and the overall stability of the financial system. Non-performing loans (NPLs), generally defined as loans for which borrowers have failed to meet their contractual repayment obligations beyond a specified period, constitute a key indicator of loan portfolio quality. Their evolution reflects the interaction between borrower-specific characteristics, bank-specific factors, and the prevailing macroeconomic environment.

From a macroeconomic perspective, the literature emphasizes that fluctuations in economic activity directly affect households' repayment capacity and, consequently, the level of non-performing loans.

The theoretical foundations underlying this relationship mainly rely on Business Cycle Theory, Asymmetric Information Theory, and the Credit Channel Theory. According to Business Cycle Theory, periods of economic expansion improve household income, employment, and repayment capacity, whereas economic downturns increase the likelihood of loan defaults. Asymmetric Information Theory, developed notably by Stiglitz and Weiss (1981), argues that information imperfections between lenders and borrowers may generate adverse selection and moral hazard, thereby increasing credit default risk. Similarly, the Credit Channel Theory highlights the role of monetary conditions and interest rates in determining borrowing costs and borrowers' financial solvency.

Among the macroeconomic determinants most frequently examined in the literature, economic growth has received considerable attention. Most empirical studies report a negative relationship between gross domestic product (GDP) growth and non-performing loans. Improved economic performance generally promotes job creation, increases household income, and strengthens borrowers' repayment capacity. Studies by Nkusu (2011), Louzis et al. (2012), and Klein (2013) demonstrate that stronger economic growth significantly reduces credit risk. Nevertheless, several authors argue that the magnitude of this relationship varies according to a country's economic structure, the level of financial development, and the nature of macroeconomic shocks.

The unemployment rate is another major determinant of household credit risk. Rising unemployment reduces disposable income, weakens households' financial position, and mechanically increases the probability of

default. Beck et al. (2015) identify a positive relationship between unemployment and non-performing loans across a broad sample of countries, a finding also confirmed by Louzis et al. (2012) for the Greek banking sector. However, other studies suggest that the strength of this relationship depends on social protection systems, government employment policies, and labor market structures.

Inflation remains one of the most debated macroeconomic determinants in the literature, with mixed empirical evidence. According to Fisher's (1933) Debt-Deflation Theory, moderate inflation may reduce the real value of debt and facilitate loan repayment, thereby lowering the level of non-performing loans. Conversely, Nkusu (2011) argues that high inflation erodes households' purchasing power, increases living expenses, and weakens repayment capacity. These contrasting findings indicate that the impact of inflation depends largely on the prevailing economic environment, wage dynamics, and the monetary policy framework.

Interest rates also represent a key determinant of banking sector asset quality. Higher interest rates increase borrowing costs, raise households' debt-servicing burden, and consequently increase the probability of default, particularly among highly indebted borrowers. Jiménez and Saurina (2006) demonstrate that tighter monetary policy contributes to a deterioration in loan portfolio quality. Similar evidence is provided by Espinoza and Prasad (2010), who report a positive relationship between interest rates and non-performing loans in several emerging economies.

Beyond traditional macroeconomic variables, several authors emphasize the importance of household indebtedness. Excessive debt accumulation increases households' financial vulnerability to adverse economic shocks, including income losses, rising interest rates, and inflationary pressures. Foos et al. (2010) show that rapid credit expansion often precedes a deterioration in bank asset quality, particularly during periods of economic slowdown.

Although the international literature on non-performing loans is extensive, empirical studies specifically investigating the macroeconomic determinants of household non-performing loans in Morocco remain relatively scarce. Existing research mainly focuses on aggregate banking sector NPLs or adopts static econometric approaches that do not simultaneously capture both short-run and long-run dynamics. Furthermore, the profound transformations experienced by the Moroccan economy in recent years—including the consequences of the COVID-19 pandemic, inflationary pressures, and the gradual tightening of monetary policy—highlight the need for updated empirical evidence.

Against this background, the present study seeks to fill this gap by examining the macroeconomic determinants of household non-performing loans in Morocco over the period 2005–2024. Unlike previous studies, it employs the Autoregressive Distributed Lag (ARDL) model, which is particularly appropriate for small samples and variables integrated of mixed orders. This econometric framework makes it possible to estimate both the short-run and long-run effects of macroeconomic variables on household credit risk, thereby providing a more comprehensive understanding of the mechanisms driving the evolution of household non-performing loans in the Moroccan context.

Table 1. Summary of Empirical Studies on the Macroeconomic Determinants of Non-Performing Loans

Author(s)	Country	Period	Main Variables	Methodology	Main Findings
Stiglitz & Weiss (1981)	United States	Theoretical	Asymmetric information	Theoretical model	Information asymmetry increases credit risk through adverse selection and moral hazard.
Jiménez & Saurina (2006)	Spain	1984–2003	Interest rate, GDP	Panel data	Higher interest rates increase NPLs, whereas economic growth reduces them.
Espinoza & Prasad (2010)	GCC Countries	1995–2008	GDP, Inflation, Interest rate	Dynamic panel	Macroeconomic conditions significantly influence non-performing loans.

Nkusu (2011)	26 Advanced Economies	1998–2009	GDP, Unemployment, Inflation	Panel data	Economic growth reduces NPLs, whereas unemployment increases them.
Louzis et al. (2012)	Greece	2003–2009	GDP, Unemployment, Interest rate	Dynamic panel	NPLs are mainly explained by economic growth and unemployment.
Klein (2013)	Central and Eastern Europe	1998–2011	GDP, Unemployment, Inflation	Panel data	Bank asset quality is strongly influenced by macroeconomic conditions.
Beck et al. (2015)	75 Countries	2000–2010	GDP, Unemployment	Panel data	Unemployment is a major determinant of credit default risk.
Foos et al. (2010)	16 Countries	1997–2007	Credit growth	Panel data	Excessive credit growth leads to a deterioration in bank asset quality.

The literature reviewed above highlights the importance of further investigating the macroeconomic determinants of household non-performing loans in Morocco using an econometric framework capable of capturing both short-run and long-run dynamics. By employing the ARDL approach, this study aims to provide updated empirical evidence and contribute to a better understanding of household credit risk within the Moroccan banking sector.

RESEARCH HYPOTHESES DEVELOPMENT

Drawing upon the theoretical foundations and empirical evidence presented in the literature, this study aims to examine the effects of key macroeconomic determinants on household non-performing loans (NPLs) in Morocco. Based on the theoretical framework and previous empirical findings, the following research hypotheses are proposed:

- **H1: Economic growth exerts a negative effect on household non-performing loans in Morocco:** This hypothesis is supported by the studies of Nkusu (2011), Louzis et al. (2012), and Klein (2013), which argue that stronger economic growth improves household income, enhances borrowers' repayment capacity, and consequently reduces the likelihood of loan default.
- **H2: The unemployment rate has a positive effect on household non-performing loans:** An increase in unemployment reduces household income and weakens borrowers' financial conditions. As highlighted by Beck et al. (2015) and Louzis et al. (2012), deteriorating labor market conditions increase the probability of default and contribute to the accumulation of non-performing loans.
- **H3: The lending interest rate has a positive effect on household non-performing loans:** According to Jiménez and Saurina (2006) and Espinoza and Prasad (2010), higher lending interest rates increase borrowing costs, raise households' debt-servicing burden, and consequently increase the risk of loan default.
- **H4: The inflation rate has a positive effect on household non-performing loans:** High inflation erodes households' purchasing power and increases the cost of living, thereby reducing their capacity to meet financial obligations. Consequently, inflation is expected to increase the incidence of household loan defaults.
- **H5: Household indebtedness has a positive effect on household non-performing loans :** As emphasized by Foos et al. (2010), a high level of household indebtedness increases financial vulnerability. Excessive debt accumulation raises the probability of default, particularly during periods of adverse macroeconomic conditions.

These hypotheses provide the analytical framework for the empirical investigation and serve as the basis for assessing the dynamic relationships between macroeconomic variables and household non-performing loans in Morocco. The empirical analysis is conducted using the Autoregressive Distributed Lag (ARDL) approach, which allows the simultaneous estimation of both short-run and long-run effects.

RESEARCH METHODOLOGY

This section presents the methodological framework adopted to examine the impact of macroeconomic determinants on household non-performing loans (NPLs) in Morocco. It describes the econometric model employed, the variables included in the analysis, the data sources, and the estimation techniques used to achieve the research objectives.

To investigate the dynamic relationships among the variables, this study employs the Autoregressive Distributed Lag (ARDL) model developed by Pesaran, Shin, and Smith (2001). The ARDL approach is particularly suitable for small-sample studies and allows the simultaneous estimation of both short-run and long-run relationships, even when the variables are integrated of mixed orders, provided that none of them is integrated of order two, $I(2)$.

The general specification of the ARDL model can be expressed as follows:

$$Y_t = \alpha_0 + \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{j=1}^p \beta_j X_{1t-j} + \dots + \varepsilon_t$$

The data used in this study were obtained from Bank Al-Maghrib, the High Commission for Planning (HCP), and the World Bank. The analysis covers the period 2005–2024, allowing the investigation to encompass different phases of the business cycle as well as the effects of recent economic shocks.

Table 2 presents the operational definition of the variables included in the empirical analysis.

Table 2. Operational Definition of the Variables

Source: Developed by the authors.

Variable	Abbreviation	Measurement
Dependent Variable		
Household Non-Performing Loans	NPL	Ratio of household non-performing loans to total household loans
Explanatory Variables		
Economic Growth	TCROIS	Annual growth rate of real GDP
Unemployment Rate	TCHOM	National unemployment rate
Inflation Rate	INFL	Annual percentage change in the Consumer Price Index (CPI)
Lending Interest Rate	I	Average lending interest rate
Household Debt Ratio	TEM	Household indebtedness indicator

Likewise, **Table 3** summarizes the research hypotheses and the expected direction of the relationships between the explanatory variables and household non-performing loans.

Table 3. Summary of the Research Hypotheses and Expected Effects

Source: Developed by the authors.

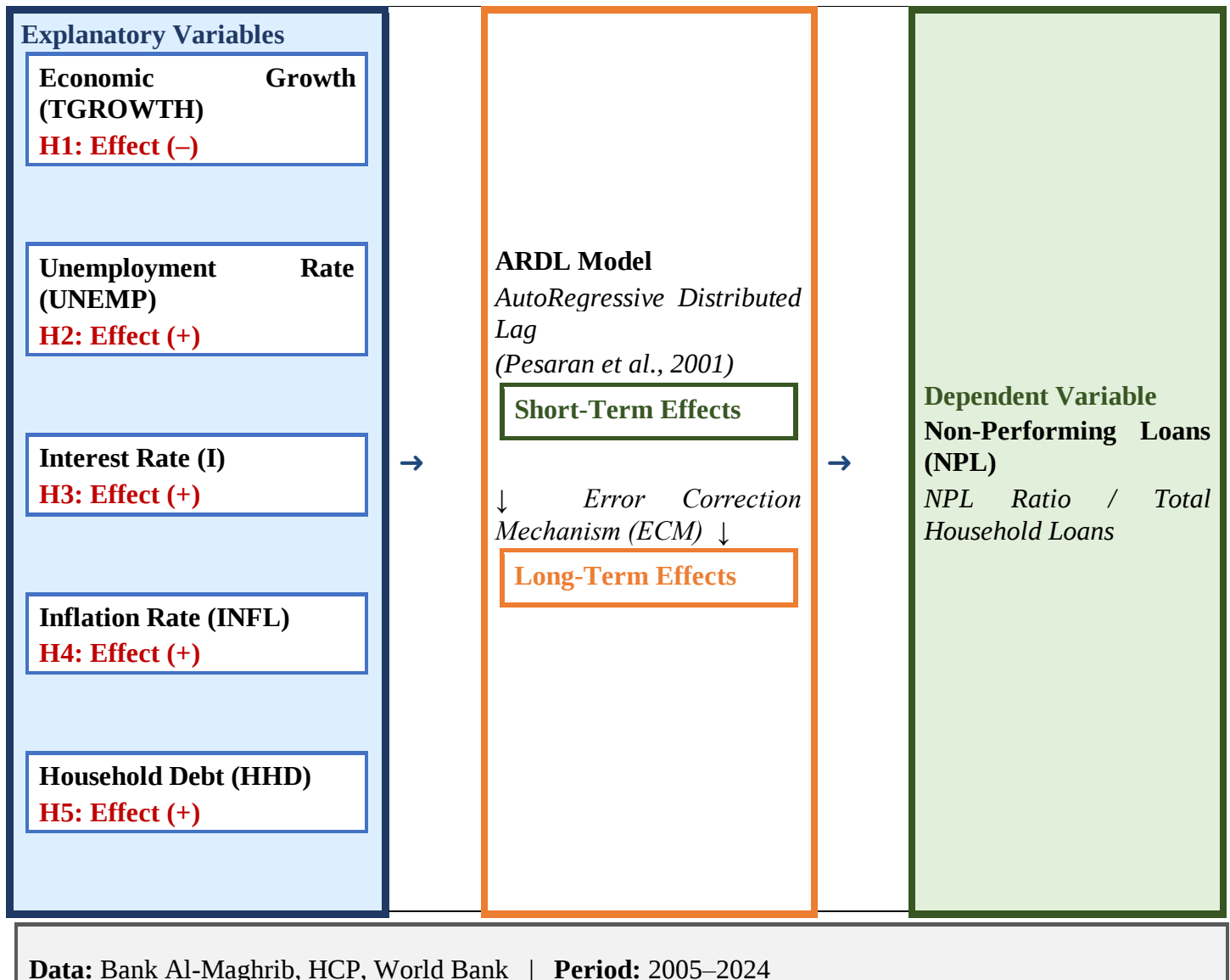
Hypothesis	Variable	Expected Sign
H1	TCROIS	(−)
H2	TCHOM	(+)
H3	I	(+)
H4	INFL	(+)
H5	TEM	(+)

To better illustrate the theoretical relationships between the macroeconomic determinants and household non-

performing loans, the conceptual framework of this study is presented in **Figure 1**.

This framework highlights the hypothesized relationships between the explanatory variables and the dependent variable, which are subsequently tested empirically using the ARDL approach.

Figure 1. Conceptual Framework: Macroeconomic Determinants of Household Credit Risk in Morocco



The empirical strategy follows a sequence of econometric procedures. First, Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests are performed to determine the order of integration of the variables. Second, the Pesaran, Shin, and Smith (2001) Bounds Test is conducted to examine the existence of a long-run equilibrium relationship among the variables. The ARDL model is then estimated using the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC) for optimal lag selection. Subsequently, an Error Correction Model (ECM) is estimated to capture the short-run dynamics and the speed of adjustment toward the long-run equilibrium. Finally, a series of diagnostic and stability tests are conducted to assess the robustness, validity, and stability of the estimated model.

DESCRIPTIVE ANALYSIS AND EMPIRICAL RESULTS

Descriptive Statistics of the Study Variables

The descriptive statistics provide an overview of the variability of the main macroeconomic and financial variables considered in this study over the period 2005–2024. The household non-performing loan (NPL) ratio

records an average value of 9.25%, ranging from 5.90% to 18.00%. This variation, reflected by a standard deviation of 3.16%, indicates moderate fluctuations in the quality of household loan portfolios throughout the study period.

The economic growth rate (TCROIS) exhibits an average of 3.48%, with values ranging from -7.20% to 8.00% , reflecting the successive phases of economic expansion and slowdown experienced by the Moroccan economy. Its relatively high standard deviation (3.11%) suggests greater volatility compared with the other variables included in the analysis.

The unemployment rate (TCHOM) averages 10.15% and remains relatively stable over the study period, as evidenced by its low standard deviation (1.42%). Similarly, the lending interest rate (I) records an average of 2.71%, with limited dispersion (0.60%), reflecting the relative stability of Morocco's monetary policy during the sample period.

Regarding the inflation rate (INFL), the average value is 1.94%, varying between 0.20% and 6.60%, which indicates a generally moderate inflationary environment despite occasional episodes of rising prices. The household debt ratio (TEM) averages 26.61%, with values ranging from 17.00% to 31.00%, suggesting a gradual evolution of household indebtedness over the study period.

The skewness coefficients indicate that INFL, NPL, and TCHOM are positively skewed (Skewness > 0), implying that most observations are concentrated around relatively low values with a few unusually high observations. Conversely, I, TCROIS, and TEM display negative skewness (Skewness < 0), indicating a concentration of observations around relatively high values.

The kurtosis statistics reveal that the distributions of INFL, NPL, and particularly TCROIS are leptokurtic (Kurtosis > 3), suggesting a high concentration of observations around the mean and heavier tails than those of a normal distribution. In contrast, the lending interest rate (I) exhibits a platykurtic distribution (Kurtosis < 3), whereas TCHOM is approximately normally distributed and TEM is nearly mesokurtic (Kurtosis ≈ 3).

Finally, the Jarque–Bera statistics indicate that the distributions of INFL, NPL, and TCROIS deviate from normality, whereas those of I, TCHOM, and TEM are relatively closer to a normal distribution.

Table 4. Descriptive Statistics of the Study Variables

Source: Authors' compilation based on EViews output.

Variables	INFL	I	NPL	TCHOM	TCROIS	TEM
Mean	0.01935	0.02709	0.09246	0.10145	0.03480	0.26610
Median	0.01450	0.02905	0.08180	0.09550	0.03800	0.27000
Maximum	0.06600	0.03390	0.18000	0.13300	0.08000	0.31000
Minimum	0.00200	0.01500	0.05900	0.08900	-0.07200	0.17000
Standard Deviation	0.01764	0.00602	0.03161	0.01416	0.03106	0.04048
Skewness	1.62708	-0.66893	1.62903	1.14885	-1.90501	-0.95661
Kurtosis	4.67945	2.15388	4.60676	2.85385	8.29116	3.00830
Jarque–Bera	11.17511	2.08815	10.99714	4.41733	35.42715	3.05038
Observations	20	20	20	20	20	20

Correlation Analysis

The results reported in Table 5 indicate that the correlations among the explanatory variables are generally weak to moderate. Most of the Pearson correlation coefficients remain below the commonly accepted critical threshold of 0.80, suggesting the absence of strong linear dependence among the explanatory variables. This finding supports the simultaneous inclusion of these variables in the ARDL model and indicates that multicollinearity is unlikely to affect the reliability of the estimated coefficients

Table 5. Pearson Correlation Matrix of the Study Variables

Source: Authors' compilation based on EViews output.

Variables	INFL	I	NPL	TCHOM	TCROIS	TEM
INFL	1.000	-0.038	0.221	0.465	0.112	-0.259
I	-0.038	1.000	0.324	-0.356	0.368	-0.647
NPL	0.221	0.324	1.000	0.129	0.344	-0.824
TCHOM	0.465	-0.356	0.129	1.000	-0.092	-0.044
TCROIS	0.112	0.368	0.344	-0.092	1.000	-0.354
TEM	-0.259	-0.647	-0.824	-0.044	-0.354	1.000

With respect to the dependent variable (NPL), the results reveal positive correlations with the lending interest rate (0.324), economic growth (0.344), inflation (0.221), and the unemployment rate (0.129). These coefficients suggest that increases in these macroeconomic variables are associated with higher levels of household non-performing loans, although the strength of these relationships remains relatively weak to moderate.

Conversely, the household debt ratio (TEM) exhibits a strong negative correlation with non-performing loans (-0.824), indicating an inverse association between the two variables. However, it should be emphasized that correlation analysis does not imply causality, and this relationship should therefore be interpreted with caution. The econometric estimation using the ARDL model will provide a more reliable assessment of the direction and significance of this relationship after controlling for the effects of the other explanatory variables.

Furthermore, the analysis of the relationships among the explanatory variables reveals a few moderate correlations, particularly between the lending interest rate and the household debt ratio (-0.647), and between the inflation rate and the unemployment rate (0.465). Nevertheless, none of these coefficients exceeds the conventional threshold used to indicate severe multicollinearity.

Overall, these findings confirm the absence of a significant multicollinearity problem among the explanatory variables, thereby satisfying an important prerequisite for the estimation of the ARDL model and supporting the reliability of the subsequent econometric analysis.

Unit Root Analysis (Augmented Dickey–Fuller Test)

Before estimating the ARDL model, it is essential to examine the stationarity properties of the variables to determine their order of integration and to ensure that none of the series is integrated of order two, $I(2)$, which constitutes a prerequisite for the application of the ARDL methodology.

The results of the Augmented Dickey–Fuller (ADF) unit root test, reported in Table 6, reveal different orders of integration among the variables included in the study. Using a 5% significance level, the variables NPL, TCROIS, and TEM exhibit ADF test statistics that are greater in absolute value than the corresponding critical values, with p-values below 0.05. Consequently, the null hypothesis of a unit root is rejected, indicating that these variables are stationary in levels, that is, integrated of order $I(0)$.

By contrast, the variables I, INFL, and TCHOM do not satisfy the stationarity condition at their levels, as their associated p-values exceed the 5% significance threshold. Therefore, the null hypothesis of a unit root cannot be rejected, suggesting that these variables are non-stationary in levels. However, after applying the ADF test to their first differences, all three variables become statistically significant at the 5% level. The null hypothesis is therefore rejected, confirming that these variables become stationary after first differencing and are consequently integrated of order $I(1)$.

Overall, the empirical evidence indicates that the variables are integrated of mixed orders, $I(0)$ and $I(1)$, while none is integrated of order $I(2)$. This result satisfies the principal requirement for the application of the

Autoregressive Distributed Lag (ARDL) model, which is particularly appropriate for analyzing both short-run and long-run relationships among variables exhibiting mixed orders of integration.

Table 6. Unit Root Test Results: Augmented Dickey–Fuller (ADF) Test

Source: Authors' compilation based on EViews output.

Variables	ADF Statistic (Level)	p-value	Decision	ADF Statistic (First Difference)	p-value	Decision	Order of Integration
NPL	-3.512	0.0209	Stationary	—	—	—	I(0)
INFL	-2.795	0.0797	Non-stationary	-4.013	0.0084	Stationary	I(1)
I	-1.377	0.5712	Non-stationary	-3.726	0.0145	Stationary	I(1)
TCHOM	0.062	0.9534	Non-stationary	-4.133	0.0057	Stationary	I(1)
TCROIS	-5.874	0.0001	Stationary	—	—	—	I(0)
TEM	-3.548	0.0179	Stationary	—	—	—	I(0)

Estimation of the ARDL Model

After confirming that the variables are integrated of order I(0) and I(1), the Autoregressive Distributed Lag (ARDL) model was estimated following the methodology proposed by Pesaran, Shin, and Smith (2001). The optimal lag structure was automatically selected using EViews based on the Akaike Information Criterion (AIC), with a maximum lag length of one for both the dependent variable and the explanatory variables.

Among the 32 candidate specifications evaluated, the ARDL(1,1,1,1,1) model was selected as the optimal specification according to the AIC criterion. This result indicates that the dynamics of household non-performing loans depend not only on their own lagged values but also on the lagged effects of the selected macroeconomic variables.

The estimated ARDL model is specified as follows:

$$\begin{aligned}
 NPL_t = & -0.2471 + 0.9640NPL_{t-1} + 10.1068I_t - 7.7619I_{t-1} - 2.1644TCHOM_t \\
 & + 4.3183TCHOM_{t-1} - 0.5757TCROIS_t - 0.6535TCROIS_{t-1} + 0.7037TEM_t \\
 & - 0.473TEM_{t-1} - 0.9662INFL_t - 1.5672INFL_{t-1} + \varepsilon_t
 \end{aligned}$$

Table 7. Estimation Results of the ARDL (1,1,1,1,1) Model

Source: Authors' compilation based on EViews output.

Variables	Coefficient	Standard Error	t-Statistic	p-value	Model Statistics	Value
NPL(-1)	0.9640	0.2013	4.7888	0.0020	R ²	0.9671
I	10.1068	2.4266	4.1649	0.0042	Adjusted R ²	0.9154
I(-1)	-7.7619	1.6174	-4.7990	0.0020	F-statistic	18.6981
TCHOM	-2.1644	0.7881	-2.7463	0.0287	Prob(F-statistic)	0.000381
TCHOM(-1)	4.3183	0.9562	4.5163	0.0027	Durbin–Watson Statistic	2.4753
TCROIS	-0.5757	0.1914	-3.0082	0.0197		
TCROIS(-1)	-0.6535	0.1786	-3.6583	0.0081		
TEM	0.7037	0.3288	2.1405	0.0696		
TEM(-1)	-0.4730	0.3728	-1.2688	0.2451		
INFL	-0.9662	0.2749	-3.5154	0.0098		
INFL(-1)	-1.5672	0.3495	-4.4839	0.0029		
Constant	-0.2471	0.1456	-1.6965	0.1336		

The estimation results of the ARDL(1,1,1,1,1,1) model indicate that most explanatory variables exert a statistically significant influence on household non-performing loans at the 5% significance level.

The coefficient associated with the lagged dependent variable (NPL(-1)) is positive (0.9640) and highly significant ($p = 0.0020$), indicating a strong persistence in household credit risk. In other words, a higher level of non-performing loans in the previous period leads to a higher level of non-performing loans in the current period.

The lending interest rate (I) has a positive and statistically significant effect (10.1068; $p = 0.0042$), suggesting that higher borrowing costs increase households' financial burden and consequently raise the probability of loan default. Conversely, its lagged value (I(-1)) displays a negative and significant coefficient (-7.7619 ; $p = 0.0020$), indicating the presence of an adjustment effect during the subsequent period.

Regarding the unemployment rate (TCHOM), the contemporaneous coefficient is negative (-2.1644 ; $p = 0.0287$), whereas the lagged coefficient is positive (4.3183; $p = 0.0027$). These findings suggest that the adverse effect of unemployment on household non-performing loans materializes primarily with a time lag.

The economic growth rate (TCROIS) exhibits a negative and statistically significant effect in both the current period (-0.5757 ; $p = 0.0197$) and the lagged period (-0.6535 ; $p = 0.0081$). These results support the view that stronger economic growth improves households' repayment capacity and contributes to reducing credit risk.

Similarly, the inflation rate (INFL) exerts a negative and statistically significant effect on household non-performing loans in both the current period (-0.9662 ; $p = 0.0098$) and the lagged period (-1.5672 ; $p = 0.0029$). This finding suggests that, during the study period, moderate inflation may have reduced the real burden of household debt, thereby facilitating loan repayment.

By contrast, the household debt ratio (TEM) does not exhibit a statistically significant effect at the 5% significance level. Although its contemporaneous coefficient is positive (0.7037), the corresponding p-value (0.0696) exceeds the selected significance threshold. Likewise, the lagged coefficient (-0.4730 ; $p = 0.2451$) is not statistically significant. Therefore, no robust conclusion can be drawn regarding the short-run effect of household indebtedness on non-performing loans.

Finally, the constant term is not statistically significant ($p = 0.1336$), indicating that it does not make a meaningful contribution to explaining the variation in household non-performing loans.

Overall, the estimated model demonstrates an excellent goodness-of-fit, with a coefficient of determination ($R^2 = 0.9671$) indicating that 96.71% of the variation in household non-performing loans is explained by the selected explanatory variables. Furthermore, the F-statistic (18.6981; $p < 0.001$) confirms the overall statistical significance of the model, while the Durbin-Watson statistic (2.4753) suggests the absence of first-order serial correlation in the residuals.

Cointegration Analysis: Bounds Test

Following the confirmation of a long-run equilibrium relationship through the ARDL Bounds Cointegration Test, the long-run coefficients were estimated to evaluate the persistent impact of the selected macroeconomic variables on household non-performing loans (NPLs) in Morocco. The estimation results are presented in Table 9.

Table 8. Results of the ARDL Bounds Cointegration Test

Source: Authors' compilation based on EViews output.

Test	Value
F-statistic	8.2359
Number of regressors (k)	5
Lower bound I(0) at 5%	2.910

Upper bound I(1) at 5%	4.193
Decision	Reject H_0
Conclusion	Evidence of a long-run cointegration relationship among the variables

The estimated long-run coefficients generally exhibit signs that are consistent with the theoretical expectations established in the literature. Economic growth exerts a negative effect on household non-performing loans, while the lending interest rate, the unemployment rate, and the household debt ratio display positive coefficients. Conversely, inflation is found to have a negative long-run effect on household credit risk. Although these estimated signs are broadly consistent with the theoretical framework and with the short-run ARDL results, none of the long-run coefficients is statistically significant at the conventional 5% significance level.

The absence of statistically significant long-run coefficients should not necessarily be interpreted as evidence that macroeconomic conditions have no long-run influence on household credit risk. Rather, this result may reflect several econometric and structural factors that characterize the Moroccan context as well as the limitations of the available dataset.

A first explanation concerns the relatively small sample size used in this study. The analysis relies on only twenty annual observations covering the period 2005–2024. Although the ARDL methodology is widely recognized as being appropriate for small samples (Pesaran et al., 2001), the estimation of long-run coefficients generally requires a larger number of observations to achieve sufficient statistical power. With a limited sample, standard errors tend to increase, thereby reducing the likelihood that estimated coefficients reach conventional levels of statistical significance even when economically meaningful relationships exist.

A second explanation may be related to the high persistence of household non-performing loans observed in the Moroccan banking sector. As shown in the estimated ARDL model, the coefficient associated with the lagged dependent variable, $NPL(-1)$, is exceptionally high (0.9640) and highly significant. Such persistence suggests that household credit risk evolves gradually over time and that its adjustment to macroeconomic shocks occurs slowly. Consequently, most of the variation in household NPLs is explained by their own historical dynamics rather than by the immediate long-run effects of macroeconomic variables, making these long-run effects more difficult to identify statistically within a relatively short sample period.

Another possible explanation concerns the specification of the empirical model. The present study focuses exclusively on a set of macroeconomic determinants while excluding several potentially relevant variables that may influence household credit risk. For example, bank-specific characteristics such as lending standards, credit risk management practices, capital adequacy, and profitability, as well as household-specific variables such as disposable income, debt-service capacity, financial literacy, and loan composition, could contribute to explaining long-run variations in household non-performing loans. The omission of such variables may reduce the explanatory power of the estimated long-run relationships.

Furthermore, the Moroccan banking sector presents several structural characteristics that may weaken the direct transmission of macroeconomic shocks to household credit risk over the long run. Public support measures implemented during periods of economic stress, the relatively conservative lending practices adopted by Moroccan banks, and the important role of regulatory supervision by Bank Al-Maghrib may partially cushion the long-run impact of macroeconomic fluctuations on household loan performance.

It is also possible that the relationship between macroeconomic variables and household non-performing loans is not strictly linear. Previous studies suggest that household credit risk may react asymmetrically to positive and negative macroeconomic shocks or may exhibit threshold effects depending on the intensity of economic downturns. Consequently, nonlinear specifications, such as the Nonlinear Autoregressive Distributed Lag (NARDL) model, or models incorporating interaction effects between macroeconomic variables may provide a more accurate representation of these relationships.

Although the estimated long-run coefficients are statistically insignificant, their theoretical consistency remains noteworthy. Economic growth continues to display a negative relationship with household credit risk, whereas

lending interest rates and unemployment retain positive coefficients that are fully consistent with conventional credit risk theory. Likewise, the negative coefficient associated with inflation may reflect the debt-deflation mechanism proposed by Fisher (1933), according to which moderate inflation reduces the real burden of outstanding debt and temporarily improves borrowers' repayment capacity.

Given these considerations, the long-run estimates should be interpreted with caution. Rather than concluding that macroeconomic variables do not affect household credit risk in the long run, the present findings suggest that their long-run effects may be difficult to identify under the constraints imposed by a limited annual dataset and the high persistence of household non-performing loans. Future research could improve the precision of long-run estimates by employing longer time series or higher-frequency data (quarterly observations) and by applying alternative cointegration estimators such as Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS). These estimation techniques are specifically designed to address potential endogeneity and serial correlation problems and may therefore provide more robust estimates of the long-run relationship between macroeconomic conditions and household credit risk.

Estimation of the Long-Run Coefficients

Following the confirmation of a long-run equilibrium relationship through the Bounds Cointegration Test, the long-run coefficients were estimated to assess the persistent impact of the selected macroeconomic variables on household non-performing loans (NPLs). The estimation results are reported in Table 9.

Table 9. Long-Run Coefficient Estimates

Source: Authors' compilation based on EViews output

Variables	Coefficient	Standard Error	t-Statistic	p-value
Lending Interest Rate (I)	65.2203	399.2234	0.1634	0.8748
Inflation Rate (INFL)	-70.4675	403.6735	-0.1746	0.8664
Unemployment Rate (TCHOM)	59.9121	344.0552	0.1741	0.8667
Economic Growth (TCROIS)	-34.1894	193.9696	-0.1763	0.8651
Household Debt Ratio (TEM)	6.4168	42.0544	0.1526	0.8830
Constant	-6.8720	42.1117	-0.1632	0.8750

The estimated long-run coefficients generally exhibit signs that are consistent with theoretical expectations. Economic growth has a negative effect on household non-performing loans, whereas the lending interest rate, the unemployment rate, and the household debt ratio display positive coefficients. Conversely, the inflation rate exerts a negative influence on household non-performing loans.

However, none of the estimated long-run coefficients is statistically significant at the 5% significance level, as all associated p-values exceed 0.05. Consequently, the empirical evidence does not support the existence of a statistically significant long-run effect of the selected macroeconomic variables on household non-performing loans.

Therefore, these long-run estimates should be interpreted with caution, particularly in light of the limitations of the study, including the relatively small sample size, which may reduce the statistical power of the estimations.

Short-Run Dynamics: Error Correction Model (ECM)

Following the confirmation of a long-run equilibrium relationship through the ARDL Bounds Cointegration Test, an Error Correction Model (ECM) was estimated to evaluate the short-run dynamics of household non-performing loans (NPLs) and the speed at which deviations from the long-run equilibrium are corrected following macroeconomic shocks. The Error Correction Term (ECT) captures the adjustment mechanism that restores equilibrium after temporary disequilibria.

Table 10. Error Correction Model (ECM) Results

Source: Authors' compilation based on EViews output

Variable	Coefficient	Standard Error	t-Statistic	p-value
ECT(-1) [NPL(-1)]	-0.03595	0.20131	-0.17859	0.8633

The estimated coefficient of the Error Correction Term, ECT(-1), is negative (-0.03595), which is consistent with the theoretical expectations of cointegration models. A negative ECT coefficient indicates that deviations from the long-run equilibrium tend to be corrected over time, implying that household non-performing loans gradually converge toward their equilibrium path after experiencing short-run macroeconomic disturbances.

However, despite its theoretically expected negative sign, the estimated coefficient is not statistically significant at the conventional 5% significance level ($p = 0.8633$). Consequently, although the direction of adjustment is economically plausible, the empirical evidence does not provide sufficient statistical support for the existence of a significant error correction mechanism within the sample period.

At first glance, this result appears to be inconsistent with the findings of the ARDL Bounds Test, which clearly confirmed the existence of a long-run cointegration relationship among household non-performing loans and the selected macroeconomic variables. Nevertheless, such a situation is not uncommon in empirical studies based on relatively small samples and should therefore be interpreted with caution rather than viewed as evidence against the existence of a long-run relationship.

One possible explanation relates to the limited sample size employed in the present study. The empirical analysis is based on only twenty annual observations covering the period 2005–2024. Although the ARDL methodology is specifically designed to accommodate small samples, the estimation of the Error Correction Model generally requires a larger number of observations to estimate the adjustment coefficient with sufficient precision. Consequently, the statistical power of the ECM estimation may be insufficient to detect a significant speed of adjustment even when cointegration exists.

A second explanation concerns the exceptionally high persistence of household non-performing loans observed in Morocco. The estimated ARDL model reports a highly significant coefficient of 0.9640 for the lagged dependent variable NPL(-1), indicating that household credit risk evolves very slowly over time. Such a high degree of persistence suggests that current levels of non-performing loans are largely determined by their historical values, leaving only limited room for rapid adjustments following macroeconomic shocks. Under these circumstances, the speed of adjustment toward the long-run equilibrium is expected to be relatively weak and may therefore become statistically difficult to identify, particularly within a short annual sample.

Furthermore, the absence of a significant Error Correction Term may also reflect the gradual nature of household credit adjustment in the Moroccan banking sector. Unlike corporate credit portfolios, household loans are generally characterized by longer maturities, relatively stable repayment schedules, and stronger contractual rigidities. Consequently, changes in macroeconomic conditions may affect household repayment capacity only after relatively long adjustment periods, reducing the likelihood of observing a statistically significant short-run correction mechanism.

Another possible explanation relates to model specification. Although the selected ARDL model captures the principal macroeconomic determinants of household credit risk, other structural factors may also influence the adjustment process. Variables such as household disposable income, debt-service capacity, banks' lending standards, credit scoring practices, regulatory interventions, or financial support measures implemented during periods of economic stress may affect the speed with which household non-performing loans return to equilibrium. The omission of these variables may partially explain the weak statistical performance of the Error Correction Term.

In addition, the adjustment process may not be linear. Household credit risk may respond asymmetrically to favourable and adverse macroeconomic shocks, implying that positive and negative changes in economic

growth, unemployment, or interest rates do not necessarily produce identical adjustment dynamics. In this context, nonlinear econometric specifications, such as the Nonlinear Autoregressive Distributed Lag (NARDL) model or threshold models, could provide a more accurate representation of household credit risk dynamics.

Overall, the combination of a significant Bounds Test and a statistically insignificant Error Correction Term should not be interpreted as contradictory. Rather, it suggests that although a stable long-run equilibrium relationship exists between household non-performing loans and the selected macroeconomic variables, the adjustment toward this equilibrium appears to be slow and difficult to detect within the available annual dataset. These findings highlight the importance of interpreting the ECM results in conjunction with the Bounds Test rather than considering each result separately.

Future research could provide more robust evidence on the adjustment dynamics of household credit risk by extending the sample period, employing quarterly data, incorporating additional household- and bank-specific variables, or applying alternative cointegration techniques such as Vector Error Correction Models (VECM), Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), or nonlinear ARDL models.

DISCUSSION OF EMPIRICAL FINDINGS AND HYPOTHESIS TESTING

The empirical findings provide an opportunity to assess the research hypotheses formulated at the outset of this study by comparing the estimated results with the underlying theoretical expectations and the evidence reported in previous empirical studies.

- **H1: Economic growth has a negative effect on household non-performing loans.**

The ARDL estimation results indicate that economic growth (TCROIS) exerts a negative and statistically significant effect on household non-performing loans in the short run ($p < 0.05$). This finding supports Hypothesis H1 and is consistent with the studies of Nkusu (2011), Louzis et al. (2012), and Klein (2013), which argue that stronger economic activity enhances household income, improves repayment capacity, and consequently reduces the likelihood of loan default.

- **H2: The unemployment rate has a positive effect on household non-performing loans.**

The empirical results reveal a mixed impact of unemployment. While the contemporaneous coefficient is negative, the lagged coefficient is positive and statistically significant, suggesting that the adverse effects of unemployment on household non-performing loans materialize with a time lag. Consequently, Hypothesis H2 is partially supported. This finding is consistent with Beck et al. (2015) and Louzis et al. (2012), who demonstrate that worsening labor market conditions gradually deteriorate the quality of bank loan portfolios.

- **H3: The lending interest rate has a positive effect on household non-performing loans.**

The estimation results indicate that the lending interest rate has a positive and statistically significant short-run effect on household non-performing loans. This finding confirms Hypothesis H3 and is consistent with the studies of Jiménez and Saurina (2006) and Espinoza and Prasad (2010), which conclude that higher borrowing costs increase households' debt-servicing burden and consequently raise the probability of default.

- **H4: The inflation rate has a positive effect on household non-performing loans.**

Contrary to the theoretical expectation, the empirical results reveal a negative and statistically significant effect of inflation on household non-performing loans. Therefore, Hypothesis H4 is rejected. One possible explanation is that moderate inflation reduces the real value of outstanding debt, thereby temporarily easing households' financial burden and facilitating loan repayment. This finding is partially consistent with Fisher's (1933) debt-deflation theory, while contrasting with the conclusions reported by Nkusu (2011).

• **H5: Household indebtedness has a positive effect on household non-performing loans.**

The results show that the household debt ratio (TEM) has a positive coefficient, but the estimated effect is not statistically significant at the 5% significance level. Consequently, Hypothesis H5 is not supported. The absence of statistical significance may be attributed to the relatively small sample size or to the influence of additional institutional and financial factors that were not incorporated into the empirical model.

Overall, the empirical findings indicate that Hypotheses H1 and H3 are supported, Hypothesis H2 is partially supported, whereas Hypotheses H4 and H5 are not supported. These results suggest that macroeconomic conditions primarily influence household non-performing loans in the short run, while the evidence regarding long-run effects remains statistically inconclusive within the context of the present study.

Table 11. Summary of Research Hypothesis Testing

Source: Authors' compilation based on EViews output

Hypothesis	Expected Relationship	Short-Run Empirical Evidence	Decision
H1	Economic growth (TCROIS) has a negative effect on household non-performing loans (NPLs).	Negative and statistically significant coefficient ($p < 0.05$).	Supported
H2	The unemployment rate (TCHOM) has a positive effect on household non-performing loans (NPLs).	Negative contemporaneous effect but positive and statistically significant lagged effect.	Partially Supported
H3	The lending interest rate (I) has a positive effect on household non-performing loans (NPLs).	Positive and statistically significant coefficient ($p < 0.05$).	Supported
H4	The inflation rate (INFL) has a positive effect on household non-performing loans (NPLs).	Negative and statistically significant coefficient, contrary to the expected sign.	Rejected
H5	The household debt ratio (TEM) has a positive effect on household non-performing loans (NPLs).	Positive but statistically insignificant coefficient at the 5% significance level.	Not Supported

CONCLUSION

This study investigated the impact of the main macroeconomic determinants on household non-performing loans (NPLs) in Morocco over the period 2005–2024 by employing the Autoregressive Distributed Lag (ARDL) approach developed by Pesaran, Shin, and Smith (2001). After verifying the stationarity properties of the variables through the Augmented Dickey–Fuller (ADF) test, the ARDL model was estimated, and the Bounds Cointegration Test confirmed the existence of a long-run equilibrium relationship among the variables, thereby justifying the application of the ARDL framework.

The empirical findings indicate that economic growth significantly reduces household non-performing loans, whereas the lending interest rate increases household credit risk. The unemployment rate exhibits a lagged effect, suggesting that the deterioration of labor market conditions affects household repayment capacity with a time delay. Contrary to theoretical expectations, the inflation rate has a negative and statistically significant impact on household non-performing loans, while the household debt ratio does not exert a statistically significant effect at the 5% significance level. Overall, the findings suggest that macroeconomic conditions primarily influence household non-performing loans in the short run, whereas the long-run effects remain statistically inconclusive.

Beyond its empirical findings, this study contributes to the literature by providing updated evidence on the macroeconomic determinants of household non-performing loans in Morocco using a dynamic econometric framework capable of simultaneously capturing both short-run and long-run relationships. The results also contribute to the limited empirical evidence available for the Moroccan banking sector.

Nevertheless, this study is subject to several limitations. First, the relatively small sample size, consisting of only twenty annual observations, may have affected the precision of the econometric estimates, particularly those related to the long-run coefficients and the error correction mechanism. Second, the analysis focuses exclusively on macroeconomic variables and does not incorporate borrower-specific or bank-specific determinants, such as household income, borrower solvency, lending standards, credit scoring practices, or banks' risk management policies.

From a policy perspective, the findings provide useful implications for Bank Al-Maghrib, commercial banks, and financial regulators. In particular, Bank Al-Maghrib should continue to strengthen its macroprudential surveillance framework by closely monitoring macroeconomic indicators that significantly influence household credit risk, particularly economic growth, lending interest rates, unemployment, and inflation. Furthermore, commercial banks should reinforce their credit risk assessment procedures by incorporating macroeconomic stress scenarios into their lending decisions and by improving early warning systems for household credit deterioration. Strengthening financial literacy programs and promoting responsible household borrowing could also contribute to reducing future credit defaults and enhancing financial stability.

Future research could extend the analysis by using longer time series or quarterly data to improve the statistical robustness of the estimates. Moreover, incorporating institutional, financial, and behavioral variables, as well as applying alternative econometric techniques such as VAR, VECM, Panel ARDL, or NARDL models, would provide a more comprehensive understanding of the determinants of household non-performing loans and allow the investigation of potential nonlinear relationships. Such extensions would offer valuable insights for both academic research and the design of more effective macroprudential and credit risk management policies.

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