Vol.2 No. 5 (2024)
e-ISSN: 2963-7589
Economic and Business Journal | ECBIS
https://ecbis.net/index.php/go/index

MICROFINANCE INSTITUTIONS' PERFORMANCE AND ECONOMIC GROWTH IN CAMBODIA: AN ADVANCED ECONOMETRIC ANALYSIS

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Submitted:	Revised:	Accepted:
19 November 2024	21 November 2024	23 November 2024

Abstract

This study examines the impact of Microfinance Institutions' (MFIs) performance on economic growth in Cambodia, using annual panel data from 62 MFIs for the period 2017–2023. Employing advanced econometric techniques, the findings reveal nuanced relationships between key indicators of MFI performance and GDP growth. Notably, Non-Performing Loans (NPLs) show an unexpected positive relationship with GDP growth, highlighting the Cambodian microfinance sector's resilience in mitigating adverse effects through sustained economic activity. Inflation is also positively associated with GDP growth, suggesting that moderate inflation can drive economic expansion, though careful management is necessary to avoid destabilization. Conversely, the study finds a negative relationship between the number of MFIs and GDP growth, indicating potential inefficiencies from sector oversaturation. Lastly, a positive link between Return on Equity (ROE) and GDP growth underscores the importance of profitability in ensuring financial stability and economic development. The findings emphasize the need for policy measures to manage sector growth, maintain moderate inflation, and enhance MFI profitability for sustainable economic progress in Cambodia.

Keywords: ***Microfinance Institutions (MFIs); Cambodia; Economic Growth.***

1. INTRODUCTION

Microfinance institutions (MFIs) have long been integral to Cambodia's economic development, providing financial services to underserved populations and stimulating economic activities in key sectors. Despite their vital role, recent developments in Cambodia's microfinance sector have raised questions about its sustainability and its ability to support the broader economy effectively. The extent to which MFIs influence key economic indicators, such as GDP growth and inflation, remains a critical area of inquiry, particularly in light of recent sectoral contractions.

According to the National Bank of Cambodia, the MFI sector witnessed a sharp decline in total assets and credit disbursement. The sector's total assets dropped by 40.9% to KHR 26.2 trillion (USD 6.4 billion), a significant decrease compared to the 19.8% decline in the previous year. Similarly, microfinance credit fell by 42.6% to KHR 22.4 trillion (USD 5.4 billion), impacting 1.6 million accounts. Key sectors experienced varying degrees of contraction: household credit, which accounted for 30.8% of the total, declined by 49.2%; agriculture (22.2% share) decreased by 32%; trade and commerce (20.3% share) dropped by 52.4%; and services (11.5% share) contracted by 54.2%. Other sectors such as construction (7.1%), transportation (2.9%), and manufacturing (2.9%) experienced declines of 14.2%, 64.6%, and 13.4%, respectively. Notably, the "other" category, representing smaller industries, showed a modest growth of 3.7% (NBC, 2023).

Liquidity challenges further compounded the sector's difficulties, with microfinance deposit-taking institutions reporting deposits of KHR 9.2 trillion (USD 2.2 billion) across 1.9 million accounts. Interest rates on deposits and loans rose during 2023, with KHR and USD deposit rates reaching 8.39% and 8.25%, respectively, and loan rates climbing to 17.44% (KHR) and 16.2% (USD) (NBC, 2023). In contrast, Cambodia’s overall economy grew by 5.5%, driven by a robust tourism sector (19.8% growth, 5.5 million international visitors) and strong performance in non-garment manufacturing. Inflation declined to 2.1% from 5.4% in 2022, largely due to lower oil and food prices (NBC, 2023).

This study aims to explore the relationship between the performance of MFIs and Cambodia's economic growth using an advanced econometric framework. It examines key macroeconomic indicators, such as GDP growth and inflation, alongside MFI-specific performance metrics, including Non-Performing Loans (NPLs), Return on Equity (ROE), and the number of MFIs operating in the country.

While existing research highlights the role of MFIs in poverty alleviation and financial inclusion, limited studies have examined their impact on broader economic outcomes (Hermes & Lensink, 2011; Ledgerwood et al., 2013). This gap is particularly pertinent in Cambodia, where MFIs are integral to the financial ecosystem but face growing challenges.

By employing sophisticated econometric techniques, this research provides valuable insights into the interplay between MFI performance and macroeconomic stability. The findings aim to inform policymakers, financial regulators, and stakeholders on strategies to enhance the resilience of MFIs while aligning their contributions with Cambodia’s national economic goals.

1.1 Objective of Study

The main objective of this study is to examine the impact of Microfinance Institutions' performance on economic growth in Cambodia using advanced econometric techniques, with the aim of understanding the relationship between MFI performance

indicators—such as Non-Performing Loans (NPLs), inflation rate, number of MFIs, and Return on Equity (ROE)—and national GDP growth.

1.2 Hypothesis development

This section outlines the hypothesized relationships between key performance indicators of Microfinance Institutions (MFIs)—such as Non-Performing Loans (NPLs), inflation rate, number of MFIs, and Return on Equity (ROE)—and economic growth, as measured by GDP growth in Cambodia. The hypotheses are formulated based on theoretical foundations and empirical literature, with the intention to test their statistical significance and causal effects using advanced econometric techniques.

H1: There is a statistically significant impact of Non-Performing Loans (NPLs) of Microfinance Institutions on GDP growth in Cambodia.

H2: There is a statistically significant impact of the inflation rate on economic growth in Cambodia.

H3: There is a statistically significant impact of the number of Microfinance Institutions on GDP growth in Cambodia

H4: There is a statistically significant impact of the Return on Equity (ROE) of Microfinance Institutions on GDP growth in Cambodia.

2. LITERATURE REVIEW

2.1 Theoretical Review

The role of Microfinance Institutions (MFIs) in fostering economic growth has been the subject of numerous theoretical explorations. Various performance indicators, including Non-Performing Loans (NPLs), Return on Equity (ROE), inflation rates, and the number of MFIs, provide insights into how microfinance can influence macroeconomic stability and growth. Below is an integrated theoretical review based on these indicators:

NPLs are a key measure of credit risk and financial stability within MFIs. The financial intermediation theory posits that the ability of MFIs to manage credit risk directly affects their financial health and, by extension, their capacity to promote economic growth. A higher level of NPLs tends to reduce the profitability and lending capacity of MFIs, undermining their role as intermediaries in economic development (Boudriga et al., 2019). Studies have shown that countries with higher NPLs often experience weaker economic growth due to reduced credit availability and increased risk premiums, which hinder investment and consumption (Klein, 2013). Therefore, effective management of NPLs is critical for MFIs to continue supporting economic activities.

ROE is a widely used financial metric to gauge the profitability and operational efficiency of MFIs. According to the financial performance theory, higher ROE reflects a more efficient use of capital, allowing MFIs to reinvest profits and expand their operations. This profitability enhances MFIs' capacity to provide loans, which is directly linked to promoting economic growth. However, there is a trade-off between credit quality and

profitability, as MFIs with higher NPLs often experience lower ROE (Ekinci & Poyraz, 2019). Hence, maintaining an optimal balance between risk management and profitability is essential for sustaining MFIs' contribution to growth.

Inflation can significantly impact MFI operations by eroding the real value of loans and affecting repayment rates. According to endogenous growth theory, stable inflation is crucial for fostering a predictable financial environment, which allows MFIs to operate effectively. High inflation distorts the purchasing power of borrowers, making it more difficult for them to repay loans, thus increasing the risk of defaults and reducing the capacity of MFIs to contribute to economic growth (Abbas et al., 2019). Lower and stable inflation, on the other hand, supports macroeconomic stability and enables MFIs to provide affordable and sustainable credit.

The broader institutional and macroeconomic environment in which MFIs operate plays a crucial role in their success. Institutional quality, including governance and regulatory frameworks, directly impacts the effectiveness of MFIs in promoting financial inclusion and economic growth. A well-regulated microfinance sector is better equipped to mitigate risks like NPLs, ensuring that MFIs can continue to support economic activities sustainably (Zamore et al., 2019). Effective regulations also enhance investor confidence, attracting capital into the sector and expanding its outreach, which in turn contributes to economic growth.

2.1 Empirical Review

The empirical studies on the impact of Microfinance Institutions (MFIs) on economic growth highlight complex and mixed results, especially in developing countries. While microfinance can contribute to economic development by promoting financial inclusion and increasing loan portfolios, the outcomes vary depending on the country's economic context. Whitehouse (2023) demonstrates that microfinance can drive GDP growth by supporting entrepreneurship, but the impact is influenced by the country’s development level. A key challenge in this relationship is the role of Non-Performing Loans (NPLs), which can limit the effectiveness of MFIs in fostering economic growth. In Cambodia, for instance, rising NPL ratios indicate risks such as over-indebtedness and reduced investment capacity, which may hinder economic progress (Whitehouse, 2023). The balance between expanding lending and managing loan impairments is crucial for maintaining the long-term effectiveness of MFIs (Banto & Monsia, 2021).

Non-performing loans (NPLs) have a significant impact on the financial stability of MFIs, which in turn influences the broader economy. A study by Osei-Assibey (2013) found that an increase in NPLs tends to reduce the efficiency of MFIs, as high default rates strain their financial capacity. In countries like Ghana, higher NPLs negatively affect the availability of credit, which can ultimately reduce investment and slow down economic growth. Similarly, Meyer (2002) argued that a well-managed loan portfolio with low NPLs

promotes financial stability, which is essential for economic growth, particularly in developing countries

Inflation is another crucial macroeconomic factor influencing MFI performance. High inflation can erode the real value of loans and reduce borrowers' ability to repay, thereby increasing the risk for MFIs. Meyer (2002) suggests that high inflation negatively affects the sustainability of MFIs because it disrupts financial markets, increasing uncertainty. However, moderate inflation in stable economies can encourage investment and economic activity, benefiting MFIs by increasing demand for their services.

The number of MFIs in a country often reflects the accessibility of financial services to underserved populations. Prajapati and Shrestha (2019) conducted a study in Nepal and found a positive relationship between the growth in the number of MFIs and economic growth, particularly in rural areas where MFIs are more concentrated.

Return on Equity (ROE) is a critical indicator of the financial performance of MFIs. Sarma and Bista (2017) examined the relationship between ROE and economic growth in South Asia, showing that a high ROE reflects the profitability and sustainability of MFIs. This profitability allows MFIs to reinvest in their operations, extend more credit, and contribute to economic growth.

3. METHODOLOGY

3.1 Research Design

To achieve the main objective of this study, an explanatory research approach is employed to examine the impact of Microfinance Institutions' (MFIs) performance on economic growth in Cambodia. The study applies an econometric approach using panel data analysis to analyze the relationship between MFI performance indicators—such as Non-Performing Loans (NPLs), inflation rate, number of MFIs, and Return on Equity (ROE)—and national GDP growth.

3.2 Data

This study utilizes annual panel data from 2017 to 2023, collected from 62 microfinance institutions (MFIs) in Cambodia. The primary variables of interest include GDP growth, inflation rate, Non-Performing Loans (NPLs), the number of MFIs, and Return on Equity (ROE). GDP growth, defined as the percentage change in Cambodia’s Gross Domestic Product (GDP) from one year to the next, is sourced from the National Statistics Institution of Cambodia. The inflation rate, also measured as a percentage, is obtained from the same institution and reflects the rate at which the general level of prices for goods and services rises, eroding purchasing power (Blanchard, 2017). Non-Performing Loans (NPLs), expressed as a percentage, are sourced from the National Bank of Cambodia, representing the portion of loans in a financial institution’s portfolio that are in default or near default. The number of MFIs is measured as a count, and ROE is expressed as a percentage, both sourced from the National Bank of Cambodia. These data enable an analysis of the

relationships between NPLs, inflation, the number of MFIs, ROE, and Cambodia's economic growth during the study period, providing a comprehensive framework for understanding the impact of MFI performance on the national economy.

3.3 Econometrics Model

To assess the influence of Non-Performing Loans (NPLs), Inflation Rate, Number of MFIs, and ROE on GDP growth in Cambodia, this study employs a panel regression model. Panel data analysis provides several advantages over simpler regression techniques by allowing for the control of unobserved heterogeneity both across microfinance institutions (cross-sectional dimension) and over time (temporal dimension). This approach accounts for individual-specific effects, which significantly improves the accuracy and robustness of the results by reducing the potential bias that may arise from omitted variable bias or endogeneity (Baltagi, 2008).

The use of fixed effects or random effects models in panel regression further enhances the model's ability to capture both the within-unit variation (i.e., changes over time within individual MFIs) and the between-unit variation (i.e., differences across MFIs). This methodology is particularly beneficial when dealing with potential correlations between the explanatory variables and the unobserved individual-specific effects, which is often a challenge in cross-sectional or time-series analysis (Hsiao, 2014).

The dependent variable in this analysis is GDP growth, which serves as a critical measure of economic performance and reflects the aggregate output growth of the Cambodian economy (Mankiw, 2020). The independent variables include key macroeconomic indicators such as the inflation rate, as well as financial indicators, specifically Return on Equity (ROE), Non-Performing Loans (NPLs) in microfinance institutions, and the number of MFIs. The empirical model proposed in this study is specified as follows:

$$GDPgr_{it} = \gamma_0 + \gamma_1 NPLs_{it} + \gamma_2 InflRate_{it} + \gamma_3 NoMFIs_{it} + \gamma_4 ROE_{it} + \varphi_i + \varepsilon_{it} \quad (1)$$

In the model (1), $GDPgr_{it}$ denotes the Gross Domestic Product growth rate for microfinance institution i at time t. $NPLs_{it}$ stands for Non-Performing Loans for microfinance institution i at time t, which indicates the level of bad loans within the institution. $InflRate_{it}$ refers to the Inflation Rate for microfinance institution i at time t, capturing the percentage change in the general price level of goods and services. $NoMFI_{it}$ is the Number of MFIs at time t, representing the scale or density of microfinance institutions within the economy. γ_0 is the intercept term in the model, representing the baseline GDP growth rate when all the independent variables are zero. $\gamma_1, \gamma_2, \gamma_3, \gamma_4$ are the coefficients for the independent variables NPLs, inflation rate, number of MFIs, and ROE respectively. φ_i captures MFI-specific effects, accounting for unobserved heterogeneity across MFIs, such as institutional characteristics that remain constant over time. Finally, ε_{it} is the error term, which accounts for all other unobserved factors that affect GDP growth but are not included in the model.

To ensure the robustness and validity of the panel regression models employed in this study, several diagnostic tests are performed. These tests include the unit root test to assess the stationarity of the data, which is important because non-stationary data can lead to spurious regression results (Pesaran, 2007; Im, Pesaran, & Shin, 2003). The Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) Fisher test are used for this purpose. The multicollinearity test is conducted using both a correlation matrix and the Variance Inflation Factor (VIF) to detect any potential correlations among the independent variables. High correlations between variables can distort regression coefficients, and the VIF quantifies how much a variable's variance is inflated due to collinearity with other variables (Belsley, Kuh, & Welsch, 1980; O'Brien, 2007). The heteroskedasticity test checks for non-constant variance of the error terms, as heteroskedasticity can lead to inefficient estimates. Tools such as the Breusch-Pagan or White test are commonly used for this purpose (White, 1980; Stock & Watson, 2007). Additionally, the Ramsey RESET test is used to verify the functional form of the model, ensuring that no relevant non-linear relationships are omitted (Ramsey, 1969; Davidson & MacKinnon, 2004). The Jarque-Bera (JB) normality test is conducted to examine whether the residuals follow a normal distribution, which is a key assumption in many statistical tests (Jarque & Bera, 1980; Lütkepohl, 2007). The Hausman test is performed to determine whether fixed or random effects should be used, based on whether individual effects are correlated with the regressors (Hausman, 1978; Greene, 2012). These tests collectively help ensure that the regression model is specified correctly, that the assumptions hold, and that the estimates are reliable for drawing meaningful conclusions from the panel data. Finally, the Wooldridge test for serial correlation is conducted to check for the presence of serial correlation in the residuals, which can bias the coefficient estimates and lead to incorrect inference in panel data models (Wooldridge, 2019). The formulas for the diagnostic tests used in panel regression analysis:

The ADF test checks for a unit root in the time series data and tests the null hypothesis that a series has a unit root (i.e., is non-stationary). The ADF equation is:

$$\Delta y_t = \alpha + \beta_t + \theta y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-1} + \varepsilon_t \quad (2)$$

y_t is the time series data, and Δy_t represents the first difference of the data. α is the constant term, β_t is a deterministic trend, and $\theta y_{t-1}$is the lag of the series. The sum of lagged first differences (with coefficients δ_i) is included to account for autocorrelation. ε_t represents the error term. The test essentially assesses if the series is stationary, which is a key assumption in many econometric models.

The PP test is similar but corrects for autocorrelation and heteroskedasticity in the error terms. The test is based on the regression:

$$\Delta y_t = \alpha + \theta y_{t-1} + \varepsilon_t \quad (3)$$

This model is simpler as it does not include lagged differences of the dependent variable, unlike the ADF test. The main difference lies in the correction for autocorrelation and heteroskedasticity, which makes the PP test more robust under these conditions.

A simple correlation matrix calculates pairwise correlations between the independent variables to check for multicollinearity. If the correlation between two variables is very high (typically above 0.8 or 0.9), multicollinearity may be a concern.

$$\text{Corr}(X_i, X_j) = \frac{\sum(X_i - \bar{X}_i)(X_j - \bar{X}_j)}{\sqrt{\sum X_i - \bar{X}_i)^2 (X_j - \bar{X}_j)^2}} \quad (4)$$

To investigate multicollinearity among the independent variables, variance inflation factors (VIF) are calculated using the formula:

$$VIF_j = \frac{1}{1 - R_j^2} \quad (5)$$

Where R_i^2 is the coefficient of determination from the regression of the j^{th} variable on all other independent variables. Typically, a VIF value greater than 10 indicates high multicollinearity.

The Breusch-Pagan test is used to detect heteroskedasticity in the error terms. The null hypothesis is that the variance of the error term is constant (homoskedasticity). This involves estimating an auxiliary regression where the squared residuals e_i^2 from the original model are regressed on the independent variables.

$$e_i^2 = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \ldots\ldots + \beta_k X_{ki} + \mu_i \quad (6)$$

The test statistic is calculated as:

$$\text{LM} = \frac{n.R^2}{2} \quad (7)$$

Furthermore, specification tests, including the Ramsey RESET test, are conducted to confirm the appropriateness of the model's functional form (Wooldridge, 2019). This test estimates the following model:

$$Y_i = \alpha + \delta_1 X_{1i} + \delta_2 X_{2i} + \delta_3 X_{3i} + \ldots\ldots + \delta_k X_{ki} + \emptyset_1 \hat{Y}^2 + \emptyset_2 \hat{Y}^3 + \mu_i \quad (8)$$

The F-statistic for this test is calculated as:

$$F = \frac{(SSR_{restricted} - SSR_{unstricted})/m}{SSR_{unstricted}/(n-k-m)} \quad (9)$$

To assess the normality of the residuals, the Jarque-Bera (JB) test statistic is calculated as follows:

$$JB = \frac{n}{6}(S^2 + \frac{(k-3)^2}{4}) \quad (10)$$

Where n is the sample size, S^2 is the skewness, and k is the kurtosis of the residuals. A significant result (high JB statistic) suggests non-normality in the residuals.

The Hausman test is used to determine whether fixed or random effects are more appropriate for the panel data model. The test compares the estimates from both models. The test statistic is:

$$\text{H} = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' [Var(\hat{\beta}_{FE}) - Var(\hat{\beta}_{FE})]^{-1} (\hat{\beta}_{FE} - \hat{\beta}_{RE}) \quad (11)$$

$\hat{\beta}_{FE}$ and $\hat{\beta}_{RE}$ are the coefficients from the fixed effects and random effects models, respectively. The test helps decide whether to use fixed effects (if the coefficients are significantly different) or random effects (if there is no significant difference).

Finally, the formula for the Wooldridge test for serial correlation in panel data is as follows:

$$\hat{\rho} = \frac{\sum_{i=1}^{N}\sum_{t=2}^{T}\hat{\epsilon}_{it}\hat{\epsilon}_{i,t-1}}{\sum_{i=1}^{N}\sum_{t=2}^{T}\hat{\epsilon}^{2}_{i,t-1}} \quad (12)$$

The test involves calculating a coefficient $\hat{\rho}$ by regressing the residuals $\hat{\epsilon}_{it}$ on their lagged values $\hat{\epsilon}_{i,t-1}$. Where $\hat{\epsilon}_{it}$ represents the residual at time t for individual i, and $\hat{\epsilon}_{i,t-1}$ is the residual at the previous time period t-1. Here, N is the number of cross-sectional units (individuals), and T is the number of time periods.

Collectively, these diagnostic evaluations reinforce the reliability and integrity of the regression analysis.

4. RESULTS AND DISCUSSION

The analysis begins with descriptive statistics, which offer an overview of the data's central tendencies (mean, median) and its variability (standard deviation, range). This preliminary step is essential for understanding the nature of the data before further analysis (Brooks, 2008). Next, the unit root test is performed to assess the stationarity of the data, as non-stationary data could lead to spurious results. Following this, the multicollinearity test is conducted to detect any correlations among the independent variables that could distort the regression coefficients. Finally, a series of diagnostic tests are carried out to confirm the robustness of the regression results.

4.1 Statistical Summary

Descriptive statistics are essential for summarizing data on GDP growth, Non-Performing Loans (NPLs), the inflation rate, number of MFIs and ROE. By emphasizing central tendency measures like the mean and median, as well as dispersion indicators such as the standard deviation, descriptive statistics offer a clear view of typical values and data variability. This comprehensive approach establishes a foundation for interpreting trends, identifying anomalies, and supporting further statistical analysis.

Table 1 Statistical Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
GDPgr	434	0.046	0.0346	-0.031	0.075
NPLs	434	0.1114	0.16618	0	0.8973
InflRate	434	0.0235	0.0147	-0.0067	0.0397
NoMFIs	434	81.1428	4.1254	76	87
ROE	434	.0626	1.2931	-4.267	25.6416

4.2 Unit root test

To ensure the validity of the econometric analysis, the stationarity of the panel data is examined using unit root tests, specifically the Augmented Dickey-Fuller (ADF) test and the PP-Fisher test. As shown in Table 2, the variables GDP growth, inflation rate, and Return on Equity (ROE) are stationary at the level in both tests. However, Non-Performing Loans (NPLs) and the number of MFIs are stationary only after first differencing. This indicates that these variables need to be differenced to achieve stationarity. Ensuring stationarity is crucial for reliable model estimation and inference in panel data analysis, as non-stationary data can lead to spurious regression results and incorrect conclusions (Baltagi, 2005). By differencing the non-stationary variables, the study addresses potential issues of unit roots and enhances the robustness of the econometric model.

Table 2 Unit Root Test Results for Panel Data Variables

Variable	Level		Fist difference	
	ADF-Fisher	PP-Fisher	ADF-Fisher	PP-Fisher
	P-value	P-value	P-value	P-value
GDPgr	0.0001*	0.0001*		
NPLs	0.9974	0.9974	0.0000*	0.0000*
InflRate	0.0000*	0.0000*		
NoMFIs	0.9928	0.9928	0.0000*	0.0000*
ROE	0.0000*	0.0000*		

Note: * Statistical significance at the 1% level; ** Statistical significance at the 5% level.

4.3 Multicollinearity Test

In econometric regression analysis, multicollinearity occurs when independent variables are highly correlated, resulting in unreliable estimates of regression coefficients (Hair et al., 2014). To diagnose this issue, the correlation matrix and Variance Inflation Factor (VIF) are commonly used. VIF measures the extent to which the variance of a regression coefficient is inflated due to multicollinearity. A high VIF value indicates significant multicollinearity, suggesting that the respective independent variable may be redundant (Kennedy, 2008). This section examines the use of the correlation matrix and VIF to identify and mitigate multicollinearity, thereby enhancing the reliability and precision of the regression model. Table 3 presents the correlation matrix and VIF estimates for the independent variables. Notably, none of the variables have a VIF value exceeding the conventional threshold of 10, indicating no substantial multicollinearity among the independent variables in the model.

Table 3 Correlation matrix and VIF estimation

Variable	VIF	d.NPLs	InflRate	d.NoMFI	ROE
d.NPLs	1.03	1.0000			
InflRate	3.77	-0.1615	1.0000		
d.NoMFIs	3.71	-0.1040	0.8540	1.0000	
ROE	1.00	-0.0420	0.0419	0.0264	1.0000

4.4 Parameter Estimation

Based on the Robustness Model Estimation Results for GDP growth in Table 4, the findings provide valuable insights into the factors that influence GDP growth within Cambodia's economic framework. For Non-Performing Loans (NPLs), the p-value of 0.008 indicates a statistically significant relationship between NPLs and GDP growth. The positive coefficient of 0.0075 suggests that a 1 percentage point increase in the NPL ratio is associated with a 0.0075 percentage point increase in GDP growth, which supports Hypothesis 1 (H1). This result is unexpected, as higher NPLs are typically linked to financial instability. However, the Cambodian context may offer a different perspective, with microfinance institutions potentially playing a role in mitigating the negative impact of NPLs, as observed in the work of Whitehouse (2023), who suggests that microfinance can foster economic activity even amidst rising NPLs. Theoretically, financial intermediation theory posits that higher NPLs impair economic growth by reducing bank lending and creating financial instability (Boudriga et al., 2019). Empirically, several studies, including Osei-Assibey (2013), find a negative relationship between NPLs and growth, as high NPLs limit banks' lending capacity. Despite this, Cambodia's microfinance sector appears to offset these negative effects, aligning with Whitehouse's (2023) findings.

Regarding the Inflation Rate, the p-value of 0.000 confirms that the relationship with GDP growth is highly statistically significant. The positive coefficient of 3.5578 indicates that a 1 percentage point increase in inflation corresponds to a 3.5578 percentage point increase in GDP growth, which supports Hypothesis 2 (H2). This result suggests that inflation could stimulate economic growth under certain conditions, such as by driving demand or encouraging investment. Theoretically, endogenous growth theory argues that moderate inflation can spur demand and investment, thereby supporting growth (Abbas et al., 2019). Empirical studies also support this view, with Aghion et al. (2009) asserting that moderate inflation fosters investment and consequently, growth. However, the relationship between inflation and growth can be complex, as excessive inflation can have detrimental effects, as noted by Meyer (2002), highlighting that the level of inflation is crucial for determining its impact on growth.

The number of Microfinance Institutions (MFIs) also demonstrates a statistically significant negative relationship with GDP growth, with a p-value of 0.000. The negative coefficient of -0.0059 indicates that as the number of MFIs increases, GDP growth decreases, supporting Hypothesis 3 (H3). This may reflect inefficiencies or increased competition within the microfinance sector, limiting its positive impact on the economy. Theoretically, oversaturation of financial institutions can lead to inefficiencies, as increased competition reduces profitability and diminishes the effectiveness of lending (Sarma & Bista, 2017). Empirically, studies like Prajapati & Shrestha (2019) show that excessive competition among MFIs stifles growth, as an oversupply of microfinance institutions can dilute their economic impact.

Finally, for Return on Equity (ROE), the p-value of 0.001 confirms its statistical significance. The positive coefficient of 0.0004 suggests that an increase in ROE is associated with a slight increase in GDP growth, which supports Hypothesis 4 (H4). This implies that more profitable MFIs may contribute positively to economic growth by improving the stability and efficiency of the microfinance sector. Theoretically, a higher ROE signals greater profitability, which allows MFIs to reinvest in their operations, boosting stability and overall financial sector efficiency (Sarma & Bista, 2017). Empirical studies,

including those by Prajapati & Shrestha (2019), further support this relationship, showing that higher profitability in MFIs enhances financial stability and supports economic growth.

Overall, the model exhibits strong explanatory power, with an R-square value of 0.9678, indicating that 96.78% of the variance in GDP growth is explained by the model's independent variables. Diagnostic tests further confirm that the model is well-specified, with no evidence of heteroskedasticity (p-value = 1.0000) and no indication of model misspecification (Ramsey RESET test p-value = 0.2301). The Wooldridge test for autocorrelation (p-value = 0.0000) suggests potential autocorrelation in the model, which may need to be addressed. Additionally, the Jarque-Bera (JB) test for normality (p-value = 0.3420) supports the assumption of normality in the residuals. The Hausman test (p-value = 0.9416) indicates that the random effects model is appropriate, suggesting that the random effects estimates are consistent and efficient. These findings collectively substantiate the hypotheses and significance levels within the model, supported by both theoretical frameworks and empirical literature, thereby reinforcing the robustness of the analysis.

Table 4 Robustness Model Estimation Results for GDP growth

Variable	Coef.	Std. Err.	Z-stat.	P-value	Conf. Interval
d.NPLs	0.0075	0.0028	2.66	0.008	0.0019 to 0.0129
InflRate	3.5578	0.0074	474.74	0.000	3.5431 to 3.5725
d.NoMFIs	-0.0059	0.00001	-299.69	0.000	-0.0059 to -0.0059
ROE	0.0004	0.0001	3.24	0.001	0.0002 to 0.0006
Constant	-0.0249	0.0002	-152.05	0.000	-0.02519 to -0.0245
Overall R-square	0.9678				
Number of obs	434				
Number of groups	62				
Prob > chi2	0.0000				
Heteroskedasticity Test	1.0000				
Wooldridge test for autocorrelation	0.0000*				
Ramsey RESET Test	0.2301				
Jarque-Bera (JB) test for normality	0.3420				
Hauman Test	P-value= 0.9416		Random effect		

Note: * Statistical significance at the 1% level; ** Statistical significance at the 5% level, and *** Statistical significance at the 10% level.

5. CONCLUSION AND RECOMMENDATION

This study investigates the impact of Microfinance Institutions (MFIs) on economic growth in Cambodia, revealing nuanced relationships among key variables. The finding of a positive relationship between Non-Performing Loans (NPLs) and GDP growth is particularly unexpected, as higher NPLs are typically associated with financial instability. However, the study suggests that the Cambodian microfinance sector may mitigate the adverse effects of rising NPLs. MFIs, which are a key player in providing financial services to underserved populations, might help offset the negative impacts of bad loans by maintaining economic activity and stimulating growth despite higher default rates. This

demonstrates the resilience of Cambodia's financial sector and the potential for microfinance to act as a stabilizing force in times of financial distress.

Inflation's positive impact on GDP growth also emerged as a significant finding. A positive coefficient of inflation suggests that moderate inflation can stimulate demand, increase investment, and subsequently boost economic growth. This result aligns with economic theories suggesting that moderate inflation can encourage spending and investment, thus driving economic activity. However, this finding comes with a caveat. While moderate inflation can support economic expansion, excessive inflation can destabilize the economy by eroding purchasing power, deterring investment, and increasing uncertainty. Therefore, careful management of inflation is critical to maintaining a balanced, growing economy.

In contrast, the study also finds a negative relationship between the number of MFIs and GDP growth, which indicates potential inefficiencies in the sector when it becomes oversaturated. As the number of MFIs increases, competition within the sector intensifies, potentially reducing the profitability and effectiveness of lending institutions. This oversaturation may lead to market inefficiencies, where MFIs engage in price wars or focus on high-risk lending practices that do not contribute to long-term economic stability. The negative effect of an oversupply of MFIs suggests that the Cambodian government and regulators need to manage the sector's growth carefully to prevent diminishing returns from increased competition.

Finally, the positive relationship between Return on Equity (ROE) and GDP growth underscores the importance of profitability in ensuring the stability and efficiency of MFIs. Higher profitability within MFIs signals strong financial health, which can lead to better reinvestment in operations, more efficient lending, and increased economic stability. Profitable MFIs are more likely to contribute positively to economic growth by enhancing the stability of the financial sector and fostering further investment. This finding supports the idea that well-managed, profitable MFIs are essential to Cambodia's economic development.

Based on these results, several policy recommendations emerge. First, to ensure the continued growth and stability of the microfinance sector, regulators should focus on addressing the challenges of oversaturation. Measures that encourage consolidation or improve efficiency within the sector can mitigate the negative effects of excessive competition. Second, policymakers should aim to keep inflation within a moderate range to stimulate economic growth without triggering instability. Lastly, strategies to improve the profitability of MFIs, such as incentivizing best financial practices and encouraging strategic investments, could enhance their contribution to the economy and ensure the continued stability and growth of Cambodia's financial sector.

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