Empirical Analysis of Commercial Banks' Loans in Cambodia: Fixed Effect and Random Effect Models

Comment [P1]: Pooled OLS is missing from the title. See below the title reframe

Empirical Analysis of Growth Rate of Loans in Commercial Banks' as Influenced by Bank Supervision **in Cambodia Using Three Different Models**

or

An Evaluation of Bank Supervision Using the CAMEL Process and its Impact on the Growth Rate of Loans of Commercial Banksin Cambodia

ABSTRACT

This study utilized three different panel models, namely Pooled OLS, Fixed Effect, and Random Effect models, to examine the influence of the five components of banks' risk rating, known as CAMEL, on the loan growth rate of commercial banks. The measurement of these components included the equity to asset ratio for capital adequacy (C), the non-performing loan to loan ratio for asset quality (A), the operating expense to asset ratio for management capability (M), the return on asset for earning quality (E), and the liquid asset to asset ratio for liquidity (L). Furthermore, each model took into account two macroeconomic indicators, specifically the real GDP growth and the growth rate of money supply measured by broad money (M2), as control variables. Over a span of 12 years, from 2011 to 2022, a total of 22 commercial banks were carefully chosen. The results of the Fixed Effect test suggest that the FE model is more suitable when compared to the Pooled OLS model. However, the Hausman test indicates that the RE model is more appropriate than the FE model. The findings of this study revealed that the quality of assets played a highly significant role in determining the rate of loan growth. The slope coefficient in all three models was found to be statistically significant at a 5% level. Additionally, the management capability and earning quality were also found to have a statistically significant impact on the loan growth rate. Furthermore, the growth rate of real GDP was found to statistically influence the loan growth rate, whereas the impact of broad money on the loan growth rate was found to be statistically insignificant.

Comment [P2]: The abstract should be recasted to contained the 3 basic components in this order. 1 Problem stated in form of objectives 2. Method empolyed to achieve the desired objective. 3 Result and recommendation

Keywords: Loan, CAMEL, Pooled OLS, Fixed Effect, and Random Effect Models.

1. INTRODUCTION

The banking system plays a crucial role in driving economic growth in Cambodia by providing financial support to individuals and institutions in need of funds, while also accepting deposits from those with surplus funds. In 2022, commercial banks granted a total of $44.61 billion in loans, marking a significant 16.97% increase compared to the previous year's $38.15 billion. However, despite the overall growth in credit, the ratio of non-performing loans to total loans rose from 1.9% to 3%. As for deposits, commercial banks held a total of $37.66 billion in 2022, compared to $35.08 billion in 2021, reflecting a year-on-year growth rate of approximately 7.34% (National Bank of Cambodia, 2023).

In order to ensure a secure and stable banking system, the National Bank of Cambodia (NBC), which serves as the monetary authority and bank regulator, implements both off-site and on-site examinations on commercial banks. Regulatory oversight requires federally insured commercial banks to undergo regular evaluations, which encompass both on-site examinations and off-site monitoring. Off-site monitoring involves the continuous analysis of different data and information to identify any potential risks or concerns, even without physically being present at the bank's premises. On the other hand, through on-site examinations, regulators are able to conduct comprehensive assessments of the bank's operations to ensure compliance with the necessary regulations. This approach involves evaluating various aspects, referred to as CAMEL, which include capital adequacy, asset quality, management capability, earning quality, and liquidity (Federal Reserve System, 2018). Bank regulation and prudential supervision are widely accepted as effective tools that enhance the development and competitiveness of the banking industry. By implementing these measures, the sector can better safeguard itself against unforeseen financial disruptions caused by banking crises and failures. Furthermore, these mechanisms play a crucial role in minimizing the risks faced by depositors during times of financial distress. However, it is important to recognize that achieving these objectives may have consequences for the banking sector (Sah & Pokharel, 2023).

The main objective of this study is to empirically investigate the complex relationship between the evaluation of bank supervision using the CAMEL process and its impact on the growth rate of commercial bank loans in Cambodia. To achieve this, the study employs three distinct panel models: Pooled Ordinary Least Square (OLS) or Pooled OLS, Random Effect (RE), and Fixed Effect (FE) models. These models allow for a comprehensive analysis of the data and provide valuable insights into the relationship between bank supervision and loan growth.

The study is organized into five separate chapters, each serving a specific purpose. To begin, the introductory chapter offers a broad perspective on the research topic, setting the stage for the subsequent chapters. Moving on, the second chapter delves into a thorough examination of the pertinent literature, providing a comprehensive understanding of the subject matter. Chapters three and four take a more practical approach, as they outline the research methodology utilized and present the empirical findings obtained from the study. These chapters offer valuable insights into the methods employed and the results obtained, contributing to the overall credibility of the research. Lastly, the concluding chapter serves as a culmination of the entire study, summarizing the key findings that have emerged from the research. Additionally, this chapter offers valuable insights and interpretations derived from the study, providing a deeper understanding of the implications and significance of the findings. By structuring the study in this manner, the reader is guided through a logical progression of information, ensuring a comprehensive and cohesive exploration of the research topic.

Comment [P3]: The need to under take the study (Motivation for study) is not clearly captured. The problem statement is not adequate for the justification of the study

2. LITERATURE REVIEW

There exist two categories of theories regarding the impact of capital on bank lending. In accordance with the financial fragility-crowding out hypothesis, Berger and Bouwman (2021) contend that shareholders display greater hesitancy in providing loans when they allocate larger sums of money into their respective banks. Moreover, they exhibit increased prudence when making investment choices. Consequently, banks with higher capitalization may offer a reduced number of loans compared to banks with lower capitalization. Conversely, the risk absorption theory suggests that capital has a positive effect on bank lending. In line with this, maintaining a larger capital buffer enhances the ability to bear risks and safeguards banks from potential losses (Coval & Thakor, 2005). Consequently, financial institutions will be motivated to embrace a more expedited approach towards expanding their loan portfolio. Extensive research has been conducted to examine the impact of capital on bank lending. In initial investigations, numerous scholars have demonstrated that augmenting bank capital can lead to varying degrees of accelerated loan growth (Repullo, 2014).

In recent studies, Carlson et al., (2020), Louhichi and Boujelbene (2017), and Košak et al., (2015) have examined the relationship between bank capital and lending behavior using data from the US, Europe, and the global context. Their findings consistently indicate a positive correlation between bank capital and lending activity. However, there are also some conflicting conclusions. According to Kim and Sohn (2017), US banks with higher capital levels tend to expand their lending aggressively only after they have accumulated sufficient liquidity. On the other hand, Roulet (2022) focuses on banks in the euro area and discovers that capital ratios have a negative impact on retail lending during the post-2008 financial crisis period.

Asset quality is widely recognized in the literature as a crucial factor that influences bank lending. When a bank faces a high level of credit risk, it tends to prioritize strengthening its risk supervision rather than increasing its loan portfolio (Altunbas et al., 2020). Lenders become more cautious when they observe higher ratios of bad debt and loan loss provisions, which can result in stricter lending standards and a reduction in lending activities (O'Brien & Browne, 1992). Consequently, banks may become reluctant to disburse loans due to the deterioration in loan quality, leading to a decline in lending segments, as highlighted by Heid and Krüger (2011). This decline in lending can have adverse effects on bank profitability, capital adequacy, and the overall capacity of banks to support the economy (Ben Naceur et al., 2018).

Several studies have examined the relationship between asset quality and loan creation, but few have directly measured its impact. Delis et al., (2014) conducted a study using bank-level data and found that lending by US banks decreases when customers are anxious, particularly when banks face high credit risk. Adesina (2019) analyzed loan loss provisions as a measure of bank loan quality and concluded that poor asset performance hinders banks' ability to provide loans. Tracey and Leon (2011) took a different approach and discovered that banks respond differently to the non-performing loan ratio, with risky banks significantly reducing their lending when the ratio exceeds a certain threshold. However, Aysan and Disli (2019) present contrasting findings for Turkey, stating that an increase in non-performing loans does not affect bank lending activities. They argue that diversified funding can help banks withstand the reduced returns from deteriorated investments.

Jeitschko and Jeung (2005) propose that the main indicator of inadequate management systems is low cost efficiency. This suggests that managers who lack experience and expertise in credit scoring may easily approve a large number of loans. Additionally, the "moral hazard" hypothesis suggests that bank managers may be incentivized to pursue riskier investments, particularly when banks are less efficient. Consequently, poorly managed banks with greater moral hazard incentives are more inclined to adopt an aggressive lending approach. On the other hand, Berger and DeYoung (1997) present an alternative hypothesis stating that well-managed banks can sustain the same loan volume with fewer operating expenses. Therefore, banks may be motivated to enhance their revenues by accelerating the pace of loan growth, thanks to their ample resources. This implies that banks with efficient management systems can achieve the desired loan volume without incurring excessive costs. In summary, low cost efficiency serves as a primary signal of poor management systems. This can lead to managers with limited experience in credit scoring approving a high number of loans. Moreover, the "moral hazard" hypothesis suggests that poorly managed banks with greater incentives for risky investments are more likely to adopt an aggressive lending schedule. However, well-managed banks can sustain the same loan volume with fewer operating expenses, motivating them to increase loan growth speed to improve revenues.

Furthermore, the issue at hand is closely connected to the segment that delves into the pass-through mechanism of cost efficiency to interest rates on loans. Scholarly research conducted earlier has provided evidence that banks with higher levels of efficiency tend to impose lower markups, thus alleviating the burden of lending rates for their clientele (Gambacorta, 2008; Havranek et al., 2016). Consequently, the reduction in borrowing expenses may serve as an incentive for an upsurge in the demand for loans (Ben Naceur et al., 2018).

The relationship between bank profitability and lending remains uncertain in theoretical terms. Certain theoretical models propose that higher profits for banks might serve as a solution to the problem of asymmetric information (Holmstrom & Tirole, 1997). The ability of banks to effectively utilize their competitive advantages allows them to attract funding from depositors and shareholders, thereby leading to a substantial increase in their lending activities. High-profit banks, in particular, are well-positioned with a wide array of loanable funds to meet the growing demand for loans. Furthermore, Dell'Ariccia and Marquez (2006) argue that banks can enhance their lending segments by capitalizing on their superior comparative advantages, potentially resulting in relaxed lending standards or even lower lending rates. Conversely, the profitability of banks has a direct impact on their risk appetite and overall business strategies.

Rajan (2006) suggests that banks are less inclined to offer loans when they experience higher returns, as this discourages them from actively seeking out higher yields. Additionally, Laidroo (2010) argues that in a highly competitive banking sector, lower interest margins may lead to an increase in loan growth. However, it is important to note that there is a limited amount of empirical analysis conducted on the relationship between bank earnings and loan growth, and further research is needed to expand our understanding in this area. Nier and Zicchino (2023) utilize a large sample of 600 listed banks globally to establish a positive correlation between bank return (measured by return on equity) and loan growth. This finding is subsequently confirmed by Bustamante et al., (2019) in their study on the banking system in Peru. Adesina (2019) challenges the previous results by examining the relationship between bank profits (proxied by return on assets) and loan growth. Interestingly, Adesina (2019) reveals a contrasting pattern, indicating a negative linkage between bank profits and loan growth. The author interprets this as a potential consequence of banks reducing loan supply in pursuit of higher returns. However, it is important to note that the primary focus of these prior works is not on bank earnings.

The lending activity of highly liquid banks can be rationalized by the precautionary motive. Gennaioli et al., (2020) propose a model that demonstrates how banks strategically opt to acquire liquid assets as a means to secure liquidity for future investments. Additionally, due to the challenges associated with immediately disbursing funds after their collection from depositors, banks may temporarily invest in liquid asset sources that can later be replaced by loans (Broner et al., 2014). Nonetheless, the findings of Cornett et al., (2011) indicate that banks have proactively enhanced their liquidity positions in order to mitigate liquidity risk during times of stress, resulting in a decrease in investments towards new loans. Previous studies have typically employed assets and liabilities ratios to examine the relationship between liquidity positions and the growth of bank loans (Berrospide & Edge, 2010; Roulet, 2022). The results highlight the significance of maintaining higher levels of liquidity as a driving force for banks to expand their lending operations.

3. METHODOLOGY

The main objective of this study is to define variables that significantly explain the growth rate of loan of commercial banks in Cambodia. The explanatory variables of the model are CAMEL variables, which represent bank specific characteristic, and control variables.

$$Loan_{i,t} = \delta + \psi EA_{i,t} + \vartheta NPL_{i,t} + \gamma OEA_{i,t} + \alpha ROA_{i,t} + \omega Liquidity_{i,t} + \tau GDP_{i,t} + \rho M2_{i,t} + \varepsilon_{i,t}$$

The parameters to be estimated in this context are $\delta, \psi, \vartheta, \gamma, \alpha, \omega, \tau,$ and ρ, while ε represents the residual or error term. Additionally, the variable i denotes each individual bank, with a total of 22 selected banks considered in this research. Given that the study encompasses the time period from 2011 to 2022, the time period (*t*) is defined as $t = 2011, \cdots, 2022$.

The model indicates that the growth rate of loans is a function of various characteristics specific to banks, such as capital adequacy, asset quality, management capability, earnings quality, and liquidity. These characteristics are collectively known as CAMEL. Capital adequacy is measured by the ratio of equity to assets, asset quality is measured by the ratio of non-performing loans to loans, management capability is measured by the ratio of operating expenses to assets, earnings quality is measured by the return on assets, and liquidity is measured by the ratio of liquid assets to assets. In addition to these bank-specific characteristics, the loan growth rate is also controlled by the influenced of two macroeconomic indicators, namely the real GDP growth rate and broad money.

Table 1. Definition of Variables

Variable	Name	Abbreviation		Description	Scale
Dependent variable	Loan	Loan		Commercial banks' loan growth rate	%
Explanatory variables	Capital adequacy	C	EA	Equity/Asset	%
	Asset quality	A	NPL	Non-Performing Loan/Loan	%
	Management capability	M	OEA	Operating Expense/Asset	%
	Earnings quality	E	ROA	Return on Asset	%
	Liquidity	L	Liquidity	Liquid Asset/Asset	%
Control variables	Gross Domestic Product	GDP		Real GDP growth rate	%
	Broad Money	M2		Money Supply	%

Data pertaining to CAMEL variables and broad money are derived from the database of the National Bank of Cambodia. Furthermore, GDP data are gathered from the National Institute of Statistics of Cambodia. These collected data are utilized in the implementation of three distinct panel models: Pooled OLS, Random Effect, and Fixed Effect. Prior to proceeding with the estimation of all parameters of the aforementioned models, descriptive statistics are conducted. Furthermore, apart from conducting research on three separate models, an assessment is also conducted to determine the suitability of each model. The initial step involves conducting the estimation of the fixed effect model, followed immediately by the execution of the fixed effect test. Each individual bank's specific effect is represented by the symbol θ. Therefore, the null hypothesis for the fixed effect test can be expressed as follows.

$$H_0: \theta_1 = \theta_2 = \theta_3 = \cdots = \theta_{20} = \theta_{21} = \theta_{22} = \theta$$

The stated null hypothesis is rejected based on the F-statistic and the probability of the test. If the hypothesis is rejected, it implies the existence of a fixed effect, thereby indicating that the fixed effect model is more suitable than the Pooled OLS model. The suitability of random and fixed effect models is assessed through the Hausman test. The null hypothesis of this test suggests that the random effect model is more appropriate than the fixed effect model. The rejection of the null hypothesis depends on the Chi-square test and its probability.

4. RESULTS AND DISCUSSION

This section will provide an examination of summary statistics, the Pearson's correlation of independent variables, and the empirical results obtained from Pooled OLS, Fixed Effect, and Random Effect models. Table 2 showcases the inclusion of 22 chosen commercial banks (*n*) in the study, selected based on the availability of data sets spanning a period of 12 years (*T*), from 2011 to 2022. The overall sample size

Comment [P4]: How did you arrived at the n=22. Indicate your samling technique comprises 264 (*N=nT*) observations, which is derived from multiplying the number of countries by the time period.

The Pearson correlation matrix provides the correlation coefficients that quantify the extent of linear association between each pair of variables. These coefficients can range from -1 to +1. If the correlation coefficient between one or more independent variables in a regression model is +1 or -1, it signifies a complete positive or negative correlation, respectively, leading to the exclusion of such variables from the model. However, if the correlation coefficient exceeds +0.8 or -0.8, it indicates a significantly positive or negative correlation, respectively, and will undeniably affect the statistical significance of an independent variable. Table 3 illustrates that there is no presence of perfect or highly multicollinearity among all independent variables in this study.

Table 2. Summary Statistics

	Variable	Obs	Mean	Std. Dev.	Min	Max
	Loan	264	26.96	53.56	-49.21	756.05
C	EA	264	25.12	15.38	9.22	97.63
A	NPL	264	2.83	3.27	0.00	19.20
M	OEA	264	2.06	1.12	0.34	6.15
E	ROA	264	1.39	1.30	-7.92	4.41
L	Liquidity	264	40.87	13.61	13.94	85.61
	GDP	264	5.79	2.96	-3.14	7.50
	M2	264	20.20	9.19	3.94	39.41

Source: Author's calculation using Stata16.

This research study utilizes three distinct panel models: Pooled OLS, FE, and RE models. However, before proceeding, a fixed effect test is conducted to account for the specific effects of the 22 commercial banks involved. The null hypothesis of this test is$H_0: \theta_1 = \theta_2 = \theta_3 = \cdots = \theta_{20} = \theta_{21} = \theta_{22} = \theta$. The calculated F-statistic is F(5, 87) = 7.42, with a probability of 0.0763, which is below the 10% significance level. As a result, the null hypothesis is rejected, indicating the presence of a fixed effect or individual bank specific effect. Consequently, the FE model is considered more appropriate than the Pooled OLS model. To assess the suitability of fixed effects and random effects models, the Hausman test is employed in this study. The null hypothesis of this test suggests that there is no systematic difference in coefficients. If the null hypothesis is rejected, the FE model is deemed more suitable than the RE model. The calculated Chi-square value for the Hausman test is chi2(7) = 0.68, with a probability of 0.9985, which exceeds the 5% significance level. This indicates that the null hypothesis is not rejected. Both the FE and Hausman tests confirm that the RE model is the most appropriate model when compared to the Pooled OLS and FE models.

Table 3. Pearson Correlation Matrix

			C	A	M	E	L		
		Loan	EA	NPL	OEA	ROA	Liquidity	GDP	M2
	Loan	1							
C	EA	-0.0553	1						
A	NPL	-0.1451	0.0378	1					
M	OEA	-0.1037	0.2378	-0.0257	1				
E	ROA	-0.0551	-0.1209	-0.0553	-0.3309	1			
L	Liquidity	-0.018	0.2416	0.0091	-0.1206	-0.1898	1		

GDP	0.1038	0.0259	-0.0901	-0.0414	0.037	0.0424	1	
M2	-0.0166	-0.0043	-0.0252	-0.0478	0.0564	0.0765	0.295	1

Source: Author's calculation using Stata16.

According to the empirical findings of the random effects model, it has been established that four out of the seven independent variables, specifically non-performing loan (A), management capability (M), earning quality (E), and economic growth (Real GDP growth rate), have a statistically significant impact on loan in the 22 commercial banks. It is important to note that A (-2.3996) and M (-6.6696) have a statistically significant negative effect on loan growth rate at the 5% and 10% levels, respectively. Furthermore, the slope coefficient of ROA (E) is negative at -4.9534 and is significant at the 10% level, indicating that an increase in return on asset will result in a decrease in commercial banks' loan. There are two control variables, the growth rate of real GDP and the growth rate of money supply, but M2 does not have a statistically significant impact on commercial banks' loan growth rate. On the other hand, the growth rate of loan is positive influenced by real GDP growth rate, as supported by the estimated parameters of 1.9122 and statistically significant at the 10% level. The Wald Chi-square statistic of the random effect model has been calculated as Wald ch2(7) = 13.670 with a probability of 0.057. Since the probability is lower than the 10% level of significance, the null hypothesis is rejected. This suggests that all variables in the model collectively explain the variation in the growth rate of loan.

Table 4. Empirical Results of Loans Panel Models

Explanatory Variables		**Pooled OLS**	**Fixed Effect**	**Random Effect**
EA	C	-0.0673	-0.0276	-0.0587
		(0.2271)	(0.2982)	(0.2476)
NPL	A	-2.4004**	-2.4297**	-2.3997**
		(1.0029)	(1.1648)	(1.0485)
OEA	M	-7.1669**	-5.4890	-6.6696*
		(3.2761)	(4.2032)	(3.5423)
ROA	E	-5.2270*	-4.1878	-4.9635*
		(2.7509)	(3.6525)	(3.0115)
Liquidity	L	-0.2158	0.0145	-0.1473
		(0.2592)	(0.3641)	(0.2892)
	GDP	1.9173*	1.8940*	1.9123*
		(1.1555)	(1.1351)	(1.1238)
	M2	-0.2763	-0.2987	-0.2827
		(0.3716)	(0.3659)	(0.3616)
Intercept		60.7872***	46.1456**	56.5405***
		(17.4994)	(23.1741)	(19.1837)
	Observation	264	264	264
	No. of banks	22	22	22
	Joint test	F(7, 256) = 2.23**	F(7,235) = 1.53	Wald chi2(7) = 13.6708*
		Prof > F = 0.0322	Prof > F = 0.1579	Prob > chi2 = 0.0570
Fixed Effect test	F(21, 235) = 1.51*			
	Prof > F = 0.0763			
Hausman test	chi2(7) = 0.68			
	Prob>chi2 = 0.9985			

***, **, * significant at 1%, 5%, 10%, respectively. Standard error in parenthesis.

Source: Author's calculation using Stata16.

According to the findings from the Pooled OLS analysis, the variables of non-performing loan, management capability, earning quality, and real GDP growth rate continue to significantly explain the loan growth rate. Furthermore, the estimated parameter signs for each variable remain consistent when compared to the results of the RE model. In the RE model, three of the CAMEL variables (A, M, and E) have negative signs, with values of -2.4003, -7.1668, and -5.2270, respectively. This suggests that these variables have a negative impact on the loan growth rate. Additionally, the real GDP growth rate continues to positively influence the loan growth rate, as evidenced by the estimated slope coefficient of 1.9173, which is statistically significant at the 10% level. Interestingly, the joint test of $F(7, 256) = 2.23$, with a probability of 0.0322 (lower than the 5% significance level), indicates that all explanatory variables in the Pooled OLS model jointly influence the loan growth rate. On the other hand, the empirical results of the Fixed Effect model suggest that all explanatory variables have a joint insignificant influence on the loan growth rate, as the calculated F-statistic is $F(7, 235) = 1.53$, with a probability of 0.1579 (greater than the 5% significance level). Furthermore, among the five CAMEL items, only one item, asset quality as measured by non-performing loan, has a statistically significant impact on the growth rate of the loan at the 5% level.

5. CONCLUSION

Three different panel data models, namely Pooled OLS, Fixed Effect, and Random Effect models, were utilized in this research to examine the impact of five components of CAMEL (capital adequacy, asset quality, management capability, earning quality, and liquidity) on loan growth rate of commercial banks in Cambodia. The measurement of these components involved equity to asset ratio for capital adequacy (C), non-performing loan to loan ratio for asset quality (A), operating expense to asset ratio for management capability (M), return on asset (ROA) for earning quality (E), and liquid asset to asset ratio for liquidity (L). Additionally, each model considered two macroeconomic indicators, namely real GDP growth and the growth rate of money supply measured by broad money (M2), as control variables.

Asset quality, as measured by the non-performing loan to loan ratio, emerged as the most crucial factor among the five components of CAMEL in determining the loan growth rate. This significance was evident in all three panel models, with the estimated slope parameter being statistically significant at a 5% level. The estimated coefficients for Pooled OLS, Fixed Effect, and Random Effect models were -2.4004, -2.4297, and -2.3997, correspondingly. The negative coefficients suggest that as the non-performing loan to total loan ratio increases, the growth rate of loan decreases. Additionally, a higher NPL ratio is associated with poorer loan or asset quality. The loan growth rate was negatively affected by the quality of management. The estimated coefficient of M in the Pooled OLS model was -7.1669, while in the Random Effect model it was -6.6696. Both models showed statistically significant slope coefficients, with the Pooled OLS model at a 5% level and the Fixed Effect model at a 10% level. In conclusion, as the banks' operational expenses to total assets ratio increases, their loan growth rate decreases. However, it can be inferred that if the operating expenses as a ratio of assets decrease, the banks' loan growth would increase. This highlights the importance of good management capability as a competitive advantage, leading to lower operational costs and higher quality loans. Likewise, it was observed that there is a significant adverse effect of the earning ratio, E, on the loan growth rate, suggesting that as the ROA increases, the loan growth rate decreases.

Two out of the five components of CAMEL, namely capital adequacy and liquidity, were found to be statistically insignificant in explaining the loan growth rate of commercial banks across all three panel models: Pooled OLS, Fixed Effect, and Random Effect models. Furthermore, out of the two control variables, namely the real GDP growth rate and the growth rate of money supply, only one indicator, the real GDP growth rate, was found to statistically explain the loan. On the other hand, the influence of broad money on loan growth rate was deemed statistically insignificant.

The study conducted three distinct panel models: Pooled OLS, Fixed Effect, and Random Effect models, to examine the influence of the five components of the bank risk assessment technique, known as CAMEL, on the loan growth rate of commercial banks. Regrettably, these three panel models were unable to capture the dynamic effect of the loan model. To enhance the comprehensiveness of this research, it is strongly advised that future researchers incorporate the dynamic panel model when investigating commercial banks' loans in Cambodia.

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