

UNIVERSITI TEKNOLOGI MARA

**A STUDY ON MACROECONOMIC
DETERMINANTS AND THE
INCLUSION OF UNEXPECTED
CRISES TOWARDS
NON-PERFORMING LOANS
AMONG MALAYSIAN
CONVENTIONAL BANKS**

ELIA ARIANA BINTI MAZLAN

MSc

July 2026

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ELIA ARIANA BINTI MAZLAN

Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science
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CONFIRMATION BY PANEL OF EXAMINERS

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ABSTRACT

A resilient conventional banking sector is pivotal for fostering economic development, particularly in emerging economies such as Malaysia, where banks play a crucial role in driving credit creation, profitability, and overall growth. This study examines the correlation between key macroeconomic indicators and unexpected crises towards non-performing loans in Malaysian conventional banks from 2002 to 2023, employing panel data analysis with Stata software. Analyzing data on 17 conventional banks, this research investigates the impact of macroeconomic variables, including the unemployment rate, gross domestic product growth, inflation rate, lending interest rate, and exchange rate, on the NPLs. It also identifies the influence of unexpected crises, such as the Global Financial Crisis (GFC) and the Covid-19 pandemic. Thus, the analysis revealed that all factors have statistical significance and influence the movement of NPLs in Malaysian banks. The unemployment rate, GDP growth, lending interest rate, and Covid-19 pandemic variable all showed a significant positive connection with NPLs, suggesting that higher unemployment, changes in lending interest rates, economic expansion, and the pandemic lead to higher loan defaults. In contrast, the inflation rate, exchange rate, and global financial crisis variables had a significant negative relationship with NPLs. By analyzing these periods of expansion and the ongoing economic downturn due to the pandemic, the research sheds light on the impact of macroeconomic variables and unexpected crises on NPLs. Moreover, this study addresses a significant gap in existing literature by highlighting the overlooked influence of pandemic years on NPLs. Furthermore, this study results in two significant contributions by including the pandemic years as a key variable and the exchange rate fluctuations in the analysis toward the NPLs. The findings offer valuable insights for Malaysian conventional banks, policymakers, and individuals seeking similar studies, contributing to advancing knowledge in banking and macroeconomics. Therefore, this research emphasizes the importance of a resilient banking sector in sustaining economic stability and growth in emerging economies like Malaysia.

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LIST OF SYMBOLS

Symbols

H_0	Null Hypothesis
H_1	Alternative Hypothesis
B	Vector Of Coefficients
β_0	Intercept Term In The Regression Equation
$\beta_1 - \beta_7$	Coefficient Of The Independent Variables
ε	Error Term
i	Banks/Sample
t	Year
$y = \ln(x)$	Transformation Equation Where Y Is The Natural Logarithm Of X
VIF_j	Variance Inflation Factor
α_i	Individual Specific (Fixed Effect)
w	Modified Wald Test Statistic
$\hat{\sigma}$	Overall Variance Across All Group
v_i	Degrees Of Freedom Adjustment For Group I .
V_{it}	The Error Term For Individual I At Time T
$i-1$ to N_g	Each Individual Group (Bank), Starting From The First Group
Σ	Summation Symbol
Y_{it}	The Dependent Variable For Individual I At Time T
X_{it}	Vector Of Explanatory Variables For Individual I At Time T
T	Balance Panel (Number Of Time Period)
T_i	Unbalanced Panel (Number Of Time Period)
ε_{it}	Error Term For The Regression Equation At Time T In Bank I

J	The Number Of Independent Variables
N	The Number Of Individuals In Panel
R^2	A Measure Of The Proportion Of The Variance In The Dependent Variable
$u_i = 0$	No Individual-Specific Effects

LIST OF ABBREVIATIONS

Abbreviations

ADF	Augmented Dickey-Fuller
AKPK	Agensi Kaunseling dan Pengurusan Kredit
ARDL	Autoregressive Distributed Lag
BG	Breusch-Godfrey
BNM	Bank Negara Malaysia
BPLM	Breusch Pagan Lagrange Multiplier Test
CEE	Central and Eastern European
CDO	Collateral Debt Obligation
CDS	Credit Default Swap
CPI	Consumer Price Index
DW	Durbin-Watson
EView-9	Econometric View, Version 9
EView-10	Econometric View, Version 10
GDPG	Gross Domestic Product Growth
GFC	Global Financial Crises
GIL	Gross Impaired Loans
GIPSI	Greece, Ireland, Portugal, Spain and Italy
GLS	Generalized Least Square
GMM	Generalised Method of Moments
IMF	International Monetary Fund
INF	Inflation Rate
IPS	Im, Pesaran and Shin
LIR	Lending Interest Rate
LLC	Levin, Lin and Chu
MENA	Middle East and North Africa
MYR	Malaysian Ringgit
NPL	Non-Performing Loan
OLS	Ordinary Least Square
PDC	Covid-19 Pandemic

PDRM	Panel Data Regression Model
PP	Phillips-Peron
REER	Real Effective Exchange Rate
SAARC	South Asian Association for Regional Cooperation
S&P	Standard and Poor
SME	Small Medium Enterprises
SPSS	Statistical Package for the Social Sciences
STATA	Statistics and Data
UNEMP	Unemployment Rate
UOB	United Overseas Bank
VAR	Vector Auto-Regression
VIF	Variance Inflation Factor Test
WLS	Weighted Least Square

CHAPTER 1

INTRODUCTION

1.1 Research Background

1.1.1 Non-Performing Loan in Malaysian Conventional Banks

A Non-Performing Loans (NPLs) measures the bank's credit risk level. Meanwhile, credit risks are risks of financial institutions associated with the non-payment of borrowing/financing provided to a borrower at the maturity date, causing the lender to incur losses. In addition, the reason for employing NPL as an indicator of credit risk management in the model is that the variable conveys credit risk characteristics and its frequency of occurrence in prior studies such as Anita et. al (2022), Castro (2013), Chaibi and Ftiti (2015), Huan et al. (2020), Mahyoub and Said (2021), Marouf and Guellil (2017), Messai and Gallali (2019), Yusuf et al. (2021), and Zainol et al. (2018). Other than that, central bankers agreed that banks' high credit risk drove the financial sector's distress during financial crises, mainly conveyed by the large number of NPLs held by banks. Besides that, according to Bank Negara Malaysia (BNM), NPLs are those with an outstanding loan balance from the borrower. Meanwhile, the International Monetary Fund (IMF) states that NPLs arise if a borrower's payment is past due by more than 90 days or whenever the interest has been renegotiated, postponed, or rescheduled for more than 90 days.

In the banking sector, various terms describe the NPLs, including Gross Impaired Loans (GILs). Banks such as Maybank have consistently used the term GILs in their annual reports since 2011, replacing the term NPLs. According to Maybank, loans are categorized as NPLs when the principal, interest, or both have been past due for three (3) months or more. Meanwhile, a loan is classified as a GIL if it shows credit weakness in less than three (3) months. In addition, if a GIL has been rescheduled or restructured, it will remain classified as a GIL until repayments have been observed continuously for six (6) months. Hence, despite this difference, the researcher found a few studies that treated GILs as NPLs in their empirical analysis, as observed in the studies by Klein (2013) and Ahmed et al. (2021). This suggests that while GILs and

NPLs are not similar, an increasing ratio of GILs indicates that the situation is already concerning and not a good omen for banks.

NPLs play a crucial role in assessing the strength and sustainability of a country's banking industry (Zainol et al. 2018). The increase in NPLs significantly impacts the banking sector's operations, indicating fundamental problems within financial institutions. For example, the NPLs affected banks' cash flows and necessitated increased collection expenditures. In other words, this matter impacted conventional banks, denting their profitability and reputation as it indicates a loss of confidence in their ability to safeguard and manage funds effectively. Also, conventional banks that are burdened with a high number of NPLs have the option to sell these NPLs at cheaper rates. For example, in 2020, CIMB Group Holding Berhad sold off a portion of its NPLs, as reported by Daljit Dhesi in *The Star* (2023). They had sold a portfolio of NPLs to Collectius, a debt management agency that specialized in managing NPLs, similar to Agensi Kaunseling dan Pengurusan Kredit (AKPK). Other than that, banks may allocate a specific amount of their profit as a loan loss reserve or cash reserve to cover any losses arising from unpaid loans.

In addition, the development of NPLs has been a growing concern, particularly in emerging countries like Malaysia. Although banks have the option to sell these NPLs, this is still a growing issue that has been a significant concern since the 1997 Asian Financial Crisis, during which NPLs surged from a modest 2.18 percent in June 1997 to a high of 11.45 percent in July 1998 (Ariff and Abubakar 1999). Historically, NPLs were increasingly strong with Western economies, especially in the Eurozone, due to occurrence of financial shocks, including the Global Financial Crisis (GFC), the Sovereign Debt Crisis, the Eurozone Crisis, and the Great Recession. On the other hand, Asian nations have suffered from the occurrence of significant devastating events such as the Asian Financial Crisis and the current COVID-19 pandemic.

The recent COVID-19 pandemic has sparked a global financial crisis, resulting in significant business losses, financial hardships for individuals and organizations, and increased layoffs, leading to higher unemployment rates. As a result, the circumstance contributes to challenges in servicing financing, which leads to NPLs. For example, a few previous studies that explored the relationship between macroeconomic factors such as Unemployment Rate, Gross Domestic Product Growth (GDPG), Inflation Rate, Lending Interest Rate, and Exchange Rate and NPLs in Asian countries include works

by Anita et al. (2022), Kartikasary et al. (2020), Koju et al. (2020), Vaicondam et al. (2019), Yusuf et al. (2021), and Zainol et al. (2018).

Moreover, while banks heavily rely on the performance of NPLs, a country's economic condition also plays a pivotal role in generating a negative impact and influencing the sensitivity of NPLs. Unexpected crises such as the Asian Financial Crisis, the GFC and the Global Pandemic can trigger bank distress in developing nations, resulting in a significant surge in NPLs during economic downturns. As previously stated, during the Asian Financial Crisis of 1997, NPLs increased modestly from 2.18 percent in June 1997 to 11.45 percent in July 1998 (Ariff and Abubakar 1999). Also, the study by Zainol et al. (2018) observed that the issue of NPLs resurfaced in 2008 and gradually declined until 2016, partly influenced by the 2007 GFC. However, the economic disruptions caused by the Covid-19 pandemic outbreak at the end of 2019 worsened the NPLs due to increased unemployment rates, business closures, and loan defaults that occurred during the period of the pandemic.

Furthermore, NPLs develop a liquidity crisis in conventional banks, leading to bankruptcy issues and a weakened economic system. The increasing trend suggests that banks may be on the verge of a liquidity crisis, posing a threat to financial stability. As a result, to ensure long-term economic and financial stability in South Asian Association for Regional Cooperation (SAARC) countries, macroeconomic determinants impacting NPLs must be assessed (Anita et al. 2022). A liquidity crisis occurs when companies or individuals can no longer finance their current liabilities with available cash. For example, individuals or companies may struggle to repay debts on time and default on payments, necessitating immediate access to cash to avoid insolvency. The study by Mileris (2014) revealed a positive relationship between NPLs in Lithuanian banks and key macroeconomic indicators, including unemployment, GDP, exports, employee remuneration, household spending, and government expenditure. This suggests that fluctuations in these economic factors coincide with an increase in NPLs, potentially leading to higher bankruptcies. Similarly, Selvanathan et al. (2016) suggested that various variables, including NPL, contributed to increased personal bankruptcy in Malaysia. The total number of personal bankruptcy cases due to NPLs is 62,122 from 2008 to 2012 (Malaysian Department of Insolvency, 2019). As a result, most previous research discovered that the primary cause of personal bankruptcy is loans (personal loans, home loans, and company loans) or installment hire-purchases, which result in

increased NPLs (Nizar and Abdul Karim, 2015). Rising bankruptcy cases, as per conventional banking organisations, indicate an increase in credit risk and potential loan defaults, which may impact banks' lending decisions and financial stability, encouraging banks to tighten lending criteria, improve credit evaluations, and make more prudent lending decisions to reduce the risk of NPLs. Also, institutions such as the AKPK play a vital role in supporting individuals in financial hardship by providing debt counselling and financial management programmes, which indirectly help banks manage NPL risks.

In addition, the government regards youth bankruptcy as a major concern because it not only has an impact on individuals' financial well-being and mental health, but it also represents a potential loss of productive human capital for the country. According to Bishop and Gripaos (2010), personal bankruptcy in most countries increases when there is an economic shock, which we could give as an example of the Asian financial crisis, the GFC, and the recent crisis of the COVID-19 pandemic. As a result, it is critical to explore the relationship between macroeconomic conditions, unexpected crises, and NPLs, particularly to understand how these factors lead to increased bankruptcy rates and affect banking sector stability.

Lastly, according to the study by Anita et al. (2022), increasing NPLs also leads to fewer investment opportunities in all conventional banks. Investors may look for those with a healthy financial statement because the stock price of a lender increases in tandem with the number of NPLs. Besides, investors find banks with higher levels of NPLs on their books less appealing. According to Mahyoub and Said (2021), Malaysia's NPLs amounted to RM27.1 billion as of December 2019. Although this figure has remained relatively stable over the years, regulators are concerned about fluctuations in NPL numbers. In addition, OCBC Bank (M) Bhd's Chief Risk Officer, Thor Boon Lee, stated to The Star Online in 2022 that NPLs are expected to increase (Dhesi, 2022). However, this rise was attributed to inflation, and some borrowers had struggle to resume loan repayments after COVID-19 pandemic-related financial assistance programs, such as loan moratoriums, interest rate reductions, government grants, subsidies, and debt restructuring programs ended. Also, as of January 2026, after dealing with the crises of the Covid-19 pandemic, NPLs in Malaysia remain at 1.4%.

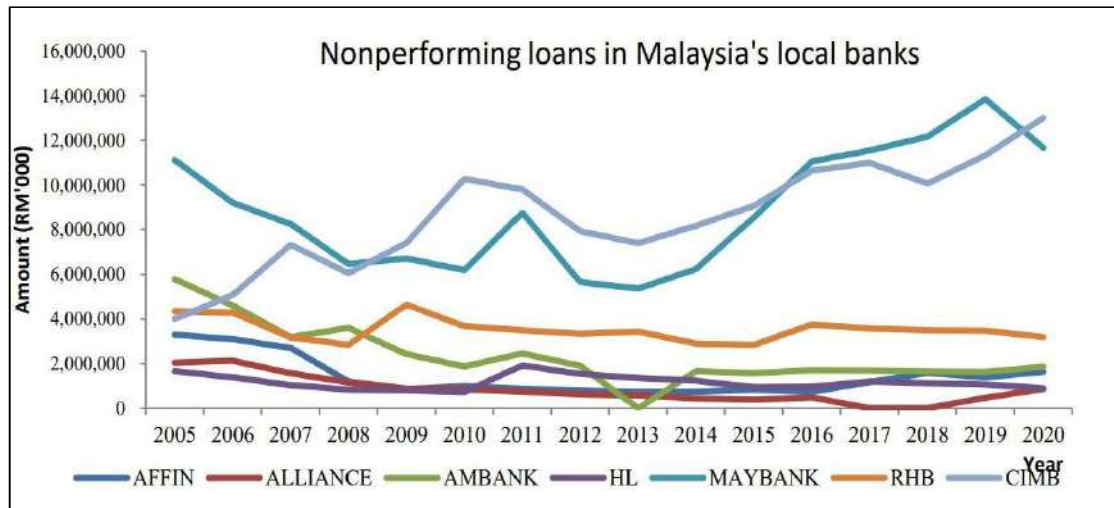


Figure 1.1 The Number of Non-Performing Loans in Selected Malaysia's Local Banks
Sources: Adopted from Zulkifli and Ahmad (2022b)

Figure 1.1 provides insight into the shifts in NPLs across prominent commercial banks in Malaysia, specifically Affin Bank, Alliance Bank, Maybank, Public Bank, Hong Leong Bank, CIMB, and RHB Bank. These banks play a crucial role in Malaysia by providing financial services and loans. Maybank, CIMB, AmBank, Alliance Bank, and Affin Bank demonstrate a greater percentage of NPLs than their rivals. This can be due to rising loan losses caused by economic difficulties.

Besides that, the movement of this trend has been volatile, varying from year to year. Except for RHB and Hong Leong Bank, all selected banks have experienced a rise in NPLs, with Maybank standing out due to a notably higher percentage of NPLs. According to Zulkifli and Ahmad (2022b), this surge is associated with a significant increase in loan loss provision, as The Star Online (2019) reported, indirectly indicating an increase in NPLs. The increase in the provision for loan losses is attributed to pre-existing and newly identified impairments, which contribute to the overall upward trend in NPLs across these banks. Therefore, this illustration provides a comprehensive overview of NPL trends in selected Malaysian banks, highlighting the challenges these financial institutions face in managing loan portfolios amid economic uncertainties.

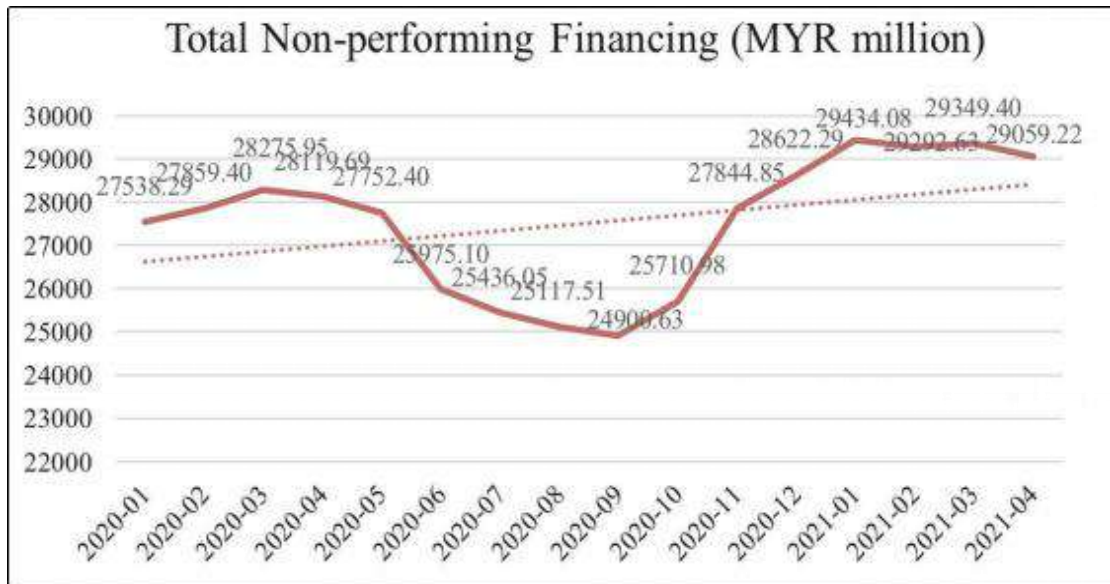


Figure 1.2 Trendline of Total Non-Performing Financing during Covid-19 (RM Million)

Source: Adopted from Ahmad et al. (2022)

Figure 1.2 shows the trendline of total non-performing financing during the COVID-19 pandemic. It illustrates a dramatic increase in NPLs throughout the crisis, with data indicating a surge in total NPL financing in early 2020. However, from March to September 2020, the total amount decreased to its lowest value of RM24,900.63 million, possibly due to government efforts to minimize the pandemic's impact. Initiatives such as the moratorium and the base rate announcement to a lower basis point were implemented. On the other hand, the moratorium was put on hold, and only those who requested the moratorium received the advantages. On the other hand, others were not classified as moratorium receivers (Ahmad et al., 2022). This suggests that not everyone, especially those not requesting the moratorium, would benefit from the relief measures, potentially leaving their financial situations unchanged. Therefore, the concern about NPLs might persist for those who did not take advantage of the moratorium or were not included in its provisions, highlighting a potential ongoing challenge in managing non-performing financing during the crisis. Moreover, as the moratorium ended, borrowers may encounter renewed challenges in servicing their loans, further impacting the landscape of NPLs. Therefore, the data above reveals a rising trend in NPLs from September 2020.

Besides that, in April 2021, 59.06 % of the total RM1.09 trillion loans were allocated to household financing. This marks a significant increase compared to the 12.5 % of RM 319.2 billion in 1996 (BNM 1998, 2021). BNM statistics highlight household

financing as the most significant contributor to sectoral non-performing financing. The quality of household financial assets heavily depends on an individual's creditworthiness, directly impacting a country's economy. It encompasses personal financing, retail mortgage lending, and individual hire purchase financing. As a result, household financing is anticipated to be severely impacted during a financial crisis or a pandemic (Ahmed et al., 2021; Ikram et al., 2022). This is driven by borrowers needing help servicing their loans due to various factors, including unemployment or low income. Also, in such circumstances, households prioritize essential basic needs such as food, healthcare, and housing above debt obligations, especially when their savings have been mainly spent during lockdowns.

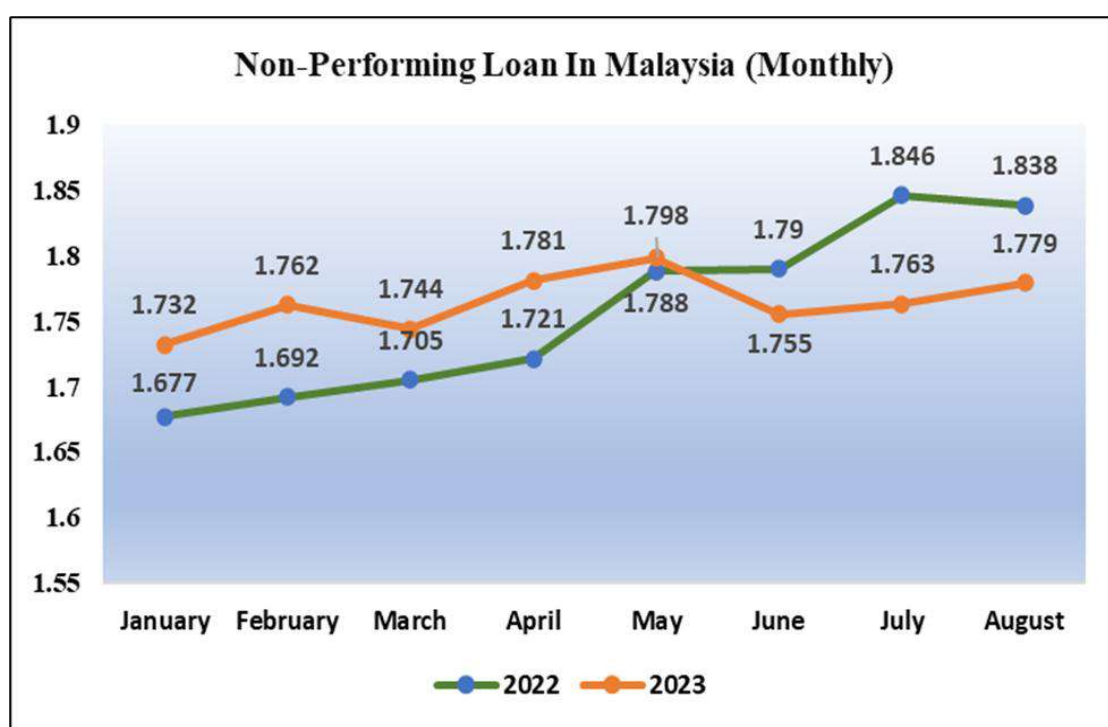


Figure 1.3 Malaysia Bank Non-Performing Loan in 2022 & 2023
Source: Global Economic Data, Indicator, Chart and Forecast Database (2023)

Figure 1.3 illustrates Malaysia's NPLs for the years 2022 and 2023 based on monthly aggregated data from the Malaysian banking systems. The graph specifically includes monthly data from January to August. However, data from September to December 2022 is missing, and the figure for December 2023's data is pending an update. Therefore, the analysis is limited and will solely focus on the months from January to August each year (2022 and 2023) to ensure consistency, specifically

focusing on the period following the COVID-19 crisis.

Figure 1.3 shows that the charts are likely to show a significant increase in NPLs in 2022. The lowest point was in January, recording a rate of 1.677%. In contrast, the highest point occurred in July, registering a rate of 1.846% before experiencing a marginal decrease of 0.008%. According to Standard & Poor's (S&P) Global Ratings, Primary Credit Analyst Nikita Anand stated to the Straits Times in July 2022 that NPLs are likely to rise due to the uneven recovery of loans under moratorium. She also highlighted that an extended recovery period for Consumers and Small and Medium Enterprises (SMEs) is expected, given the impact of COVID-19 and the inflation rate, which has already increased household indebtedness. In other words, the level of NPLs is anticipated to continue on an upward trajectory. As a result, in 2023, the aggregate data for Malaysia's banking system shows a consistent uptrend, although it has decreased a few times. The highest rate observed for 2023 is in May, which was 1.798, while the lowest was found in January, which was 1.732. However, it still cannot be compared with January 2022, which holds the lowest rate of 1.677% when comparing the figures across 2022 and 2023.

To conclude, it is critical to investigate Malaysia's conventional banking sector's NPLs and the macroeconomic factors that affect them amidst the unexpected crises. The varying NPL rates illustrate that understanding the underlying macroeconomic variables driving these trends is vital for effective risk management and policymaking. This is especially true in economic crises and ongoing problems like the COVID-19 pandemic. Risk mitigation, improved financial stability, and sustained economic growth can be achieved if researchers and policymakers further investigate the connection between macroeconomic indicators and unexpected crises towards the NPLs. As a result, for the banking industry and economy as a whole in Malaysia to remain resilient and prosperous, additional research in this field is essential.

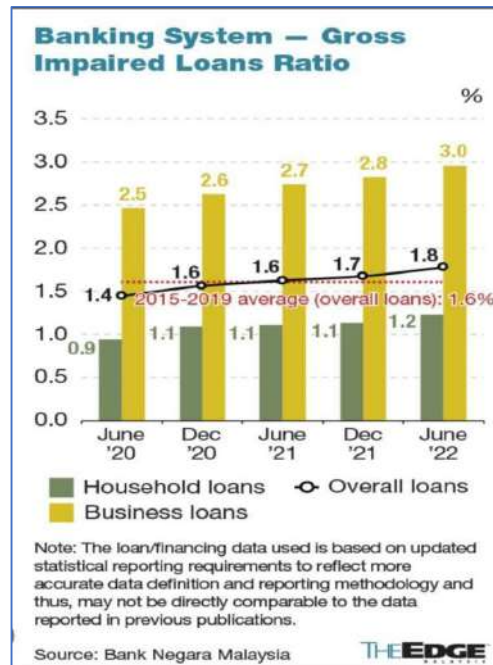


Figure 1.4 Gross Impaired Loans in the Banking System
Source: Bank Negara Malaysia (2022)

Figure 1.4 shows a significant increase in NPLs, climbing from 1.6% in June 2021 to 1.8% in June 2022. This upward trend is noticeable in both the business and household sectors. According to BNM, the increase was driven by a few vulnerable households and SMEs seeking assistance to resume loan repayments after exiting repayment assistance programs, alongside defaults from specific corporate borrowers.

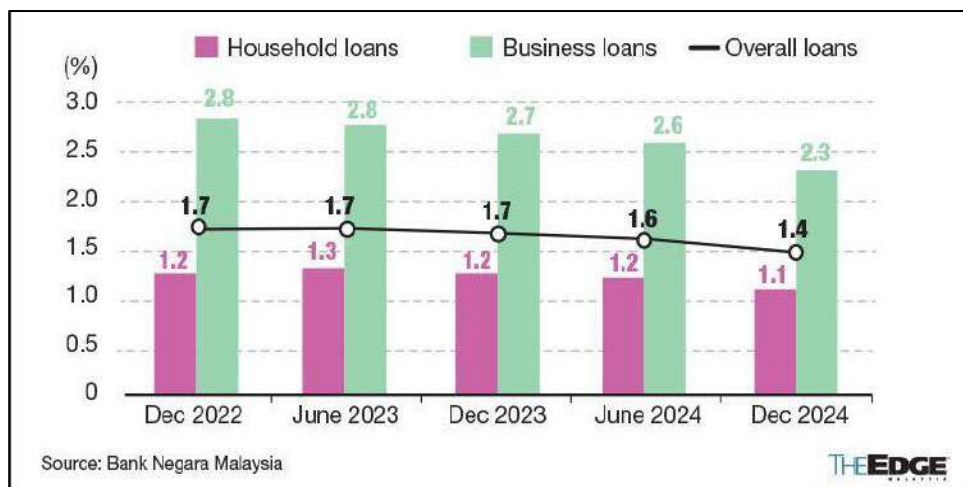


Figure 1.5 Gross Impaired Loan in the Banking System
Source: Bank Negara Malaysia (2024)

Figure 1.5 indicates that GILs have been reported at a minimal rate of 1.4%. Although the gross impaired loans ratio in Malaysia has declined to 1.4% in 2024, according to Bank Negara Malaysia, it remains crucial to stay vigilant in monitoring this metric to evaluate financial stability. Historical data indicates that financial crises can arise abruptly and develop rapidly within the banking sector. Therefore, despite current events' low rate of bad loans, banks continue to serve as an essential mechanism for the early detection of possible financial difficulty. Continuous monitoring of credit risk indicators allows policymakers and financial institutions to identify developing weaknesses and execute preventative measures before they develop into systemic banking crises. Also, Figure 1.5 illustrates that post-crisis, the NPL ratio generally requires 1-2 years to recuperate and stabilise.

The number of bankruptcy cases (from 2018 to April 2022)							
By age group	Year					Total	%
	2018	2019	2020	2021	2022		
Under 25 years	139	54	21	20	5	239	0.52
25-34 years old	4,139	2,603	1,741	1,060	370	9,913	21.49
35-44 years old	5,958	4,574	3,150	2,535	996	17,213	37.31
45-54 years old	4,022	3,087	2,211	1,802	806	11,928	25.86
55 years old and above	2,106	1,707	1,204	1,116	503	6,636	14.38
No information	118	26	24	21	14	203	0.44
TOTAL	16,482	12,051	8,351	6,554	2,694	46,132	100
By gender							
Male	11,760	8,923	6,116	4,874	1,980	33,353	72.95
Female	4,722	3,128	2,227	1,671	709	12,457	27.00
No information	0	0	8	9	5	22	0.05
TOTAL	16,482	12,051	8,351	6,554	2,694	46,132	100
Factors leading to bankruptcy							
Personal loan	4,636	5,706	4,457	3,267	1,268	19,334	41.91
Purchase vehicle	3,392	1,543	1,006	690	212	6,843	14.83
Business loan	1,424	1,846	1,223	1,202	547	6,242	13.53
Housing loan	1,982	1,138	583	459	259	4,381	9.58
Credit card	1,811	880	600	438	121	3,850	8.35
Others	1,770	425	91	126	92	2,504	5.43
Corporate guarantor	626	221	114	118	67	1,146	2.48
Income tax debt	275	261	158	147	72	913	1.98
Social guarantor	540	15	2	0	0	557	1.21
EPF contributions	0	0	105	92	52	249	0.54
Scholarships/study loans	26	16	12	15	4	73	0.16
TOTAL	16,482	12,051	8,351	6,554	2,694	46,132	100

Source: Malaysian Department of Insolvency.

TheStargraphics

Figure 1.6 The Number of Bankruptcy Cases (2018 to April 2022)

Source: Malaysia Department of Insolvency (2022)

Figure 1.6 displays the number of bankruptcy cases filed from 2018 to April 2022. It indicates that over half of the 46,132 individuals declared bankrupt during this period were attributed to personal loans, along with other factors such as car hire purchases, business loans, and housing loans contributing to bankruptcy in Malaysia.

On the other hand, in 2022, a total of 2,694 individuals were officially declared bankrupt. Additionally, the Department of Solvency reported a concerning average of 18 people declared bankrupt daily during the initial five months of 2022. This situation may also be partly due to financial hardship, reduced income, and the end of support initiatives such as loan moratoriums, which contributed to the rise in bankruptcies. Also, this could be attributed to the lingering impact of the COVID-19 pandemic, as 2022 was still in the economic recovery phase. Also, based on the figure above bankruptcy filings decreased in 2022, while NPLs in banks increased over the same period. The apparent contradiction can be explained by the government's financial assistance programs and COVID-19 loan moratoriums, which allowed borrowers to postpone payments and avoid instant bankruptcy. Despite this temporary relief, many borrowers continued to struggle with repayments, leading to an increase in NPLs.

Bankruptcy statistics in Malaysia suggest that a significant amount of personal bankruptcies stem from personal loans, hire-purchase agreements, business ventures, and housing loans. Thus, from the perspective of conventional banking, these patterns act as a preliminary indicator of increased credit risk, since high bankruptcy rates imply that borrowers may encounter difficulties in fulfilling their repayment responsibilities. As a result, banks review these changes by re-evaluating borrower creditworthiness and modifying lending methods, which involve tougher loan approval processes, enhanced risk assessments, and alterations in interest rates. To reduce the effects of increasing defaults and NPLs, banks monitor loan performance and work with financial counselling institutions like the AKPK, which aids individuals in debt management and default prevention.

Besides that, Consumer Financial Expert Prof. Dr. Mohamad Fazli Sabri encouraged the public to seek advice from specialists such as the AKPK before taking on any further loan commitments in response to the data (Morden, 2022). As a result, the table above relates to NPLs and intrigues the study of NPLs as they file for bankruptcy when an organization or a borrower cannot honour its obligations or make payments to its creditors. In other words, this figure proves that many firms or borrowers still require assistance in repaying their loans, which could lead to NPLs if not managed.

Moreover, Youth and Sports Minister Hannah Yeoh disclosed in a report released by The Star (2025) that 5,272 youths under the age of 34 were declared

bankrupt from 2020 to 2024. According to the Insolvency Department, personal loans were the leading cause of bankruptcy in 2024, accounting for 2,776 out of a total of 5,977. Surprisingly, the problem remains unsolved as of 2025, with personal loans still playing an important role in young people's financial struggles. The persistence shows the crucial need for a deeper understanding of the causes of incapacity to repay personal loans.

1.1.2 Classification of Conventional Bank Non-Performing Loans

NPLs arise when they cannot be recovered within the stated timeframe. According to Maybank Berhad (2015), a facility shall be categorized as an NPL if the outstanding balance exceeds the limit that is allowed for more than 90 days or three months. This study identifies various classifications of NPLs. Therefore, below are the classifications of NPLs in three countries: Malaysian banks and Western countries, particularly those complying with international rules established by the Basel Committee on Banking Supervision, which set global standards for banking regulation, including the classification and management of NPLs. Also, Asian countries, such as the Bank of Indonesia, detailing how they classify their NPLs.

Table 1.1
Classification of Non-Performing Loans in Malaysia

Period of Default	Classification
3 months from the first day of default but less than 6 months	Substandard
6 months from the first day of default but less than 9 months	Doubtful
9 months and above from the first day of default	Bad

Source: Bank Negara Malaysia (2015)

Table 1.1 shows the classification of NPL by the Central Bank of Malaysia. As per this categorization, a loan is deemed compromised or non-performing if the

repayment of principal or interest is past due for a period exceeding three (3) months or 90 days. Also, loans overdue for three months or longer are classified as substandard, signifying an increased risk of loss attributable to unfavourable circumstances such as delayed debt servicing, unfavourable financial conditions, inadequate collateral, or other factors that doubt the borrower's ability to repay.

Besides that, loans that are past due for more than 6 months to 9 months are classified as doubtful, signifying that the complete collection of credit facilities is improbable, with a high risk of ultimate default. Meanwhile, loans past due for more than 9 months are deemed bad debt, implying they are uncollectible and worthless based on relevant circumstances.

Table 1.2

Five-Tiers of Loans in Western Countries (United States, United Kingdom, Germany, Switzerland, and other Basel compliant countries).

Tier	Descriptions
Passed	Solvent Credits it means it can meet its long-term debt obligations
Special Mention	Borrowers within this category can meet their loan obligations. However, these loans pose a variety of challenges. These challenges embody potential weaknesses that require careful attention from the bank. Pay attention to these issues to avoid a deterioration of the loan's repayment prospects or a negative impact on the bank's creditworthiness in the future.
Substandard	Loans falling into the substandard category exhibit overdue interest or principal payments extending beyond three months, indicating uncertainty about the borrower's capacity to fulfil the debt obligation.
Doubtful	"Doubtful" indicates that the borrower cannot repay the principal and interest in full, and considerable losses will result, even if guarantees are issued.
Loss	It is a virtual loss that cannot be recovered. Outstanding debts are deemed uncollectible, and banks make a full provision for loan losses.

Source: Adapted from Zain et al. (2020)

Table 1.2 shows the five tiers of loans which are Passed, Special Mention, Substandard, Doubtful, and Loss. The table above indicates that the first two tiers, Passed and Special Mention, are still acceptable, showing that the borrowers can still pay their debts. Meanwhile, the substandard, doubtful, and loss tiers represent NPL.

Table 1.3

Types of Performing Vs Non-Performing Loans in Indonesia

Collectability Category	Types of Loans	Loan Repayment Time Span
Performing Loans	Liquid loans	Each due date
Performing Loans	Special mention loans	Less than 90 days
NPLs	Substandard loans	91 days - 120 days
	Doubtful loans	121 days -180 days
	Bad loans	More than 180 days

Source: Adopted from Singgih et al. (2014)

In Table 1.3, performing loans are categorized into two categories: Liquid loans, which are smoothly repaid without any delays, and Special Mention loans, which have some late payments but stay within the 90-day overdue limit (Bank Indonesia, 2004). Meanwhile, NPLs come in three categories: Substandard loans, indicating potential repayment challenges; Doubtful loans, suggesting a higher risk of default; and Bad debts, signalling loans deemed uncollectible and worthless based on relevant circumstances.

1.1.3 Macroeconomics Determinants and Crises on Non-Performing Loans

Amidst diverse crises and economic uncertainties, comprehending the dynamics of NPLs in Malaysian conventional banks is crucial (Zainol et al., 2018). Empirical research strongly links the macroeconomic environment to the quality of loans. Studies suggest that individuals and businesses generally have consistent income flows in economic growth periods, allowing them to fulfill their financial responsibilities swiftly (Louzis et al., 2012). However, in times of economic hardship, firms and people are more likely to default on their debts, which worsens the increase of NPLs within the

banking sector (Naili and Lahrichi, 2022). Recent research, especially during the COVID-19 pandemic, highlights the pivotal role of macroeconomic factors in shaping borrowers' repayment capabilities. The greater economic environment significantly enhances borrowers' repayment capabilities, reducing delinquency and default loans. However, during crises such as the Pandemic, borrowers may face challenges in servicing their debt due to the impact on cash flow. Therefore, this study aims to analyze how these factors directly influence NPL dynamics within Malaysian banks, with an exclusive focus on their well-established impact on macroeconomic variables and unexpected Crises as the dummy variables. To determine the influence of NPLs, they are categorized into two groups, which are the bank-specific factors (size, asset quality, and capital adequacy) and macroeconomic factors (Unemployment rate, Gross Domestic Product Growth, Inflation rate, Lending Interest rate, and Exchange rate). While recognizing the relevance of bank-specific factors, this research places lies on macroeconomic variables. Grounded in historical evidence from unexpected events like the GFC and recent economic challenges such as the COVID-19 Pandemic, this research aims to provide comprehensive insights into the relationship between macroeconomic conditions and unexpected crises towards the NPLs in Malaysian conventional banks.

In addition, prior research has extensively investigated the impact of macroeconomic indicators, including inflation, unemployment, and GDP growth, on NPLs. Meanwhile, past studies, especially those focusing on Malaysia, had less frequently studied exchange rate fluctuations. In emerging markets, currency volatility can affect borrowers' ability to repay loans and banks' credit risk (Kepeli et al., 2021). Also, the likelihood of loan defaults increased when currencies weaken and repayment costs rise, as exchange rate fluctuations may impact import-export-oriented firms and foreign debt obligations. Therefore, this study integrates exchange rate variables alongside other macroeconomic factors to provide a more comprehensive assessment of their combined impact on NPLs and banking sector stability.

Besides that, past research has predominantly concentrated on foreign nations, mainly European countries, where the relationship between NPLs and macroeconomic indicators has proven robust on the global stage (Zainol et al., 2018). Notable studies, such as the one conducted by Gashi et al. (2022), Kjosevski and Petkovski (2021), Klein (2013), Messai and Gallali (2019), and Saba et al. (2012) underscored the prevalence of NPL concerns in Western and developed nations. Also, western countries

have experienced a lasting effect from past crises, such as the subprime mortgage crisis, the Great Recession, and the European Sovereign Debt Crisis, significantly impacting their NPL patterns. For example, according to the Global Economy Database Ukraine reported the highest number of NPLs amid the worldwide financial crisis at 31.72% in 2021. Therefore, by concentrating on the macroeconomic factors affecting the NPLs and acknowledging the lessons learned from Western crises, Malaysian policymakers, regulators, and financial institutions can use the findings of this study to develop strategies such as revising existing regulations or developing new strategies that promote more excellent financial system stability, transparency, and accountability to reduce risks and efficiently manage NPLs in uncertain economic times.

Moreover, a study by Kevin and Gyong (2020) showed that borrowers' income and the value of their loans decrease when economic activity declines, which could lead to an increase in NPL rates. On the other hand, the study of Gashi et al. (2022), focusing on the Western Balkans region from 2000 to 2019, shows that countries experiencing a recession (economic downturn) tend to have high NPLs. This assertion is further supported by Messai and Jouini (2013), who note that a low number of bad loans characterizes the economic expansion phase. This is because both consumers and businesses have sufficient income to pay off their debts by the deadlines that have been set. Caprio and Honohan (2002) suggested that banking system crises, particularly when banks become insolvent, are the most severe expression of a cycle driven by economic credit. This indicates that the condition of the banking sector is closely connected to the overall state of the economy. In addition, recent banking crises have been closely linked with macroeconomic concerns. Therefore, given the current turmoil in the Malaysian economy following the COVID-19 pandemic, the rise of NPLs has been associated with macroeconomic factors, intriguing the researcher to study the topic, including the pandemic period.

Furthermore, banking crises have been closely linked with macroeconomic issues, contributing to the rise of NPLs. Past studies have demonstrated the impact of lending rates, inflation, GDPG, unemployment, and exchange rates on NPLs in various banking sectors. However, the specific relationship between macroeconomic factors and NPLs in the context of Malaysia requires further investigation. For example, while the study conducted by Saba et al. (2012) found negative impacts of lending rates on NPLs in the US banking sector, Zain et al. (2020) discovered a significant positive relationship between real effective exchange rates and NPLs in Malaysia. This study

did not include the lending rate in its research but instead had the GDP, inflation, and exchange rates, of which only the real exchange rate was found to be significant. On the other hand, Mohamed et al. (2021) found insignificant relationships between NPLs and interest rates in the Malaysian banking system. However, Mohamed et al. (2021) found a strong positive link between NPLs and inflation and a negative relationship with unemployment in Malaysia. These results contrast with worldwide trends and show that macroeconomic factors and NPLs may function differently in Malaysia. These inconsistencies show the issue's complexity and difficulty in adapting foreign models to local banks. Therefore, additional research is required to gain a better understanding of how macroeconomic issues influence Malaysian NPLs. Gaining insight into these links can assist policymakers and financial institutions in formulating effective strategies to uphold financial stability, improve risk management, and reduce the likelihood of future economic shocks.

In conclusion, the researcher firmly contends that macroeconomic indicators and the inclusion of unexpected Crises are crucial in influencing NPLs. Recognizing the importance of this relationship, the researcher aims to delve deeper into the specific impacts of macroeconomic determinants and Unexpected Crises on NPLs within 17 selected conventional Malaysian banks from 2002 to 2023.

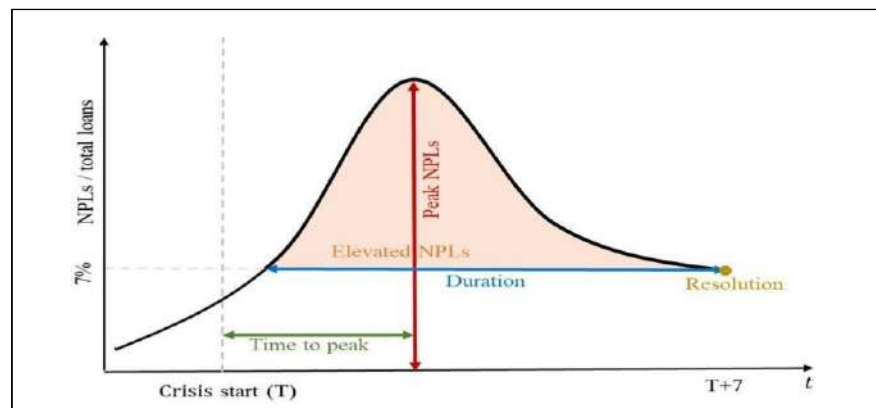


Figure 1.7 A typical NPL Trajectory
Source: Adopted from Ari et al. (2021)

Figure 1.7 is the visual representation of the NPL trajectory. It shows that the NPL started modestly and rose rapidly around the start of the crisis. Besides, the figure above shows that the NPL ratio will peak some years afterward before stabilizing and declining. However, the NPL will decrease slowly and remain above 7% in 7 years after the crisis. In other words, it was a slow recovery, which took about seven years for the

NPLs to decline. Also, according to the researcher, in some cases, the NPLs will decline and peak again, forming an M-shaped pattern.

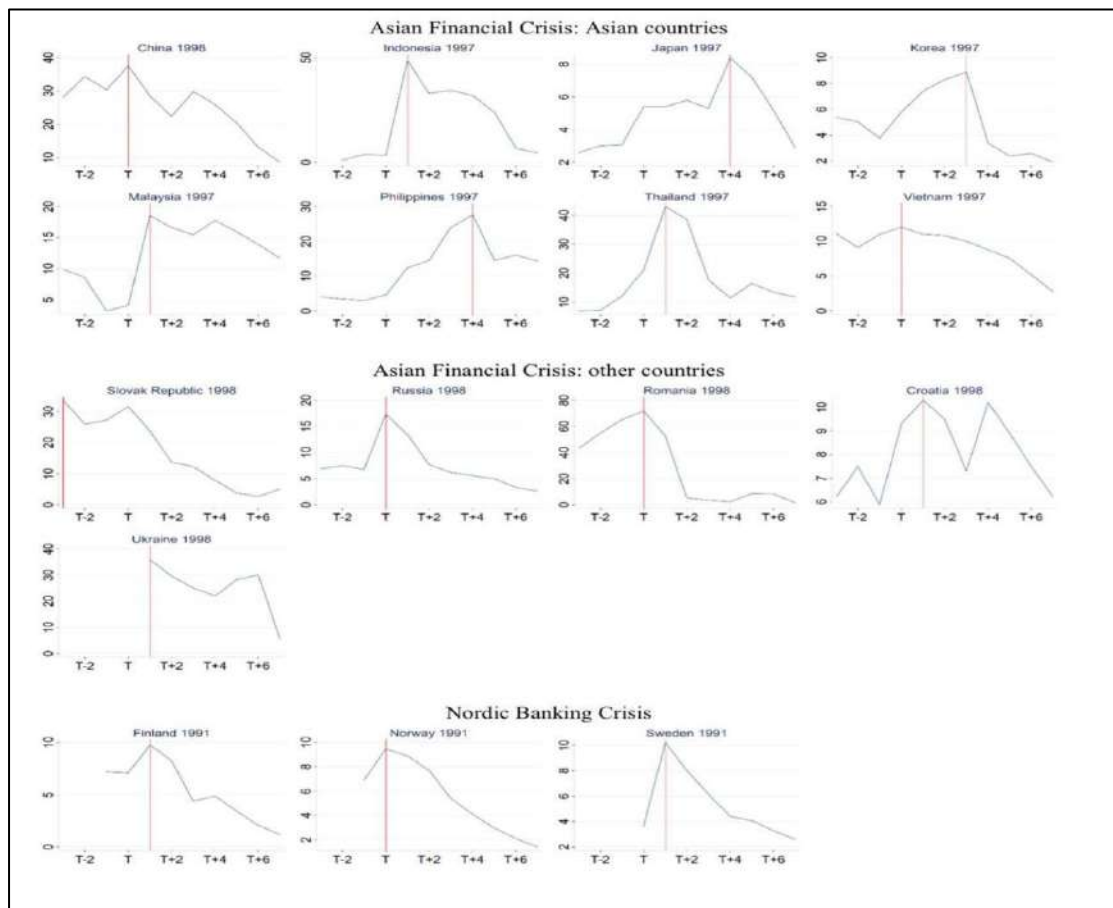


Figure 1.8 Asian Financial Crisis Impact on NPLs
Source: Adopted from Ari et al. (2021)

Figure 1.8 shows the impact of the Asian financial crisis on NPLs. It shows that among Asian countries hit by the late 1990s Asian financial crisis, NPLs rose quickly and were resolved slowly (over more than seven years), especially in Asian Countries like Malaysia, Indonesia, and Thailand.

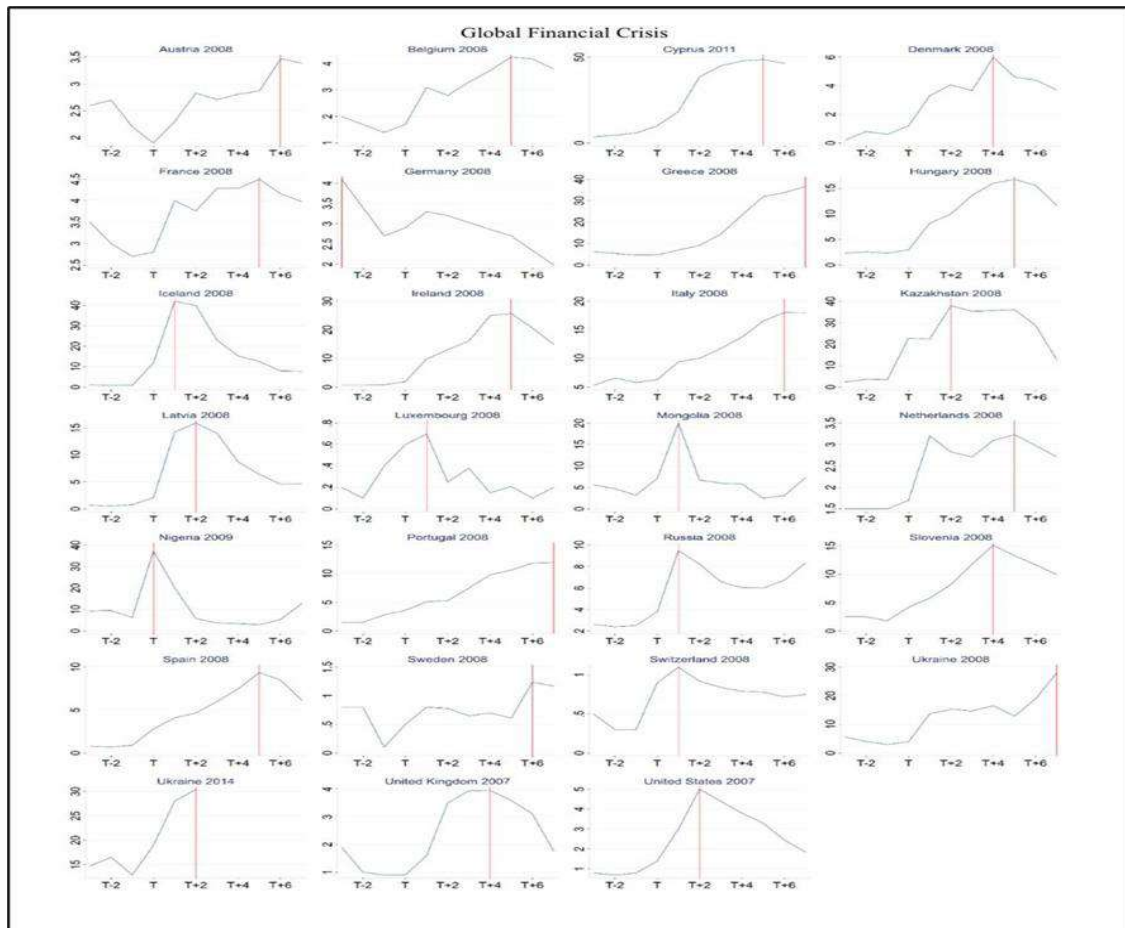


Figure 1.9 Global Financial Crisis Impact on NPLs
Source: Adopted from Ari et al. (2021)

Figure 1.9 shows the impact of the GFC on NPLs. According to Ari et al. (2021), it is similar in countries outside of Asia, which faced a prolonged recovery period, taking seven years to address their NPL issues completely. For example, during the period of the GFC, Latvia and Iceland had the fastest NPL decline in Europe, with NPL peaking two years after the crisis and being resolved a year later. However, if analysed from the graph above, it still takes them about seven years to manage the NPLs trend where it is now, which is that the NPLs are at their minimum rates.

1.2 Problem Statement

The Movement of NPLs is crucial in the banking system, as it influences the profitability, asset quality, and the overall stability of the banking sector. High NPL levels are a common feature of banking crises (Ari et al., 2021), and they often reach their highest during a period of economic instability. Despite economic stabilization and regulatory reforms, NPLs remain a significant obstacle for conventional banks in

Malaysia. Numerous macroeconomic triggers, such as the Unemployment rate, GDP Growth, Inflation rate, Lending Interest rate, and exchange rate, along with unanticipated crises such as the COVID-19 pandemic and the GFC, contribute to the consistently high levels of NPLs in the banking sector. Previous scholars had argued that macroeconomic and unexpected crises is one of the major influences on NPLs as a slowdown in the economy may reduce earning, burden borrowers financially, as well expose them to credit risk.

According to the study by Singh (2022), more than a decade has passed since the 1997 Asian Financial Crisis, and arguably, the currency and financial situation have been stabilized. However, the expansion of NPLs continues unabated in major Asian countries, including Malaysia. A study by Mahyoub and Said (2021) further supported this, mentioning that NPLs in Malaysia amounted to RM27.1 billion in December 2019. Also, previous research, such as by Zainol et., (2018) strongly links the macroeconomic environment to the quality of loans. Hence, this study examines the relationship between Macroeconomic and Unexpected crises towards the NPLs.

Besides that, despite the remarkable changes banks have undergone since recovering from the Asian Financial Crisis of 1997 and the GFC 2008, NPLs continue to pose a significant problem across the banking sector (Zulkifli & Ahmad, 2022b). The recent COVID-19 Pandemic has increased concerns about NPLs, with many banks, particularly local ones, grappling with a surge in outstanding conventional loans during the loan moratorium period. United Overseas Bank (UOB) economist Julio Goh, speaking to The Edge Markets in 2020, highlighted the risk of these loans transitioning into NPLs post-moratorium, prompting heightened concern among banks. Banks need to maintain a constant state of alertness, ensuring their capability to navigate forthcoming crises skilfully and unforeseen circumstances such as the COVID-19 pandemic. All these crises, such as the GFC and the COVID-19 pandemic, are found to be impactful events that can cause chaos in the economy and disrupt the development of the country (Basit & Soraya Sulaiman, 2017; Lee & Rosenkranz, 2020). Therefore, it is crucial to investigate the relationship between macroeconomic variables and the inclusion of unexpected crises towards the NPL.

Next, Despite Malaysia's history of economic crises, including the Asian Financial Crisis in 1997-1999 and the GFC in 2008–2009, a limited focus has been placed on examining the influence of the pandemic periods on NPL trends. For example,

recent research by Zulkifli and Ahmad (2022a) stated that the worsening of NPLs in commercial banks due to the pandemic underscored the urgency of including the years of the pandemic in their research. Similarly, Golitsis et al. (2022) addressed multiple crises, including the GFC of 2007–2009, the European Sovereign Debt Crisis of 2010–2012, the COVID-19 pandemic era, and the Russian Invasion of Ukraine. However, their focus of studies was on North Macedonia rather than Malaysia. Also, Kozarić and Delihodić (2020) emphasized the need for more comprehensive studies on the global financial crisis in the banking sector. Therefore, this study addresses the research gap by examining the impact of unexpected crises, such as the GFC and the COVID-19 pandemic, on NPLs in Malaysia's Conventional banks. Also, studies examining the impact of unexpected crises such as the GFC and the COVID-19 pandemic on NPLs in Malaysia remain relatively limited. One reason is the constraint of time-period coverage, particularly for the COVID-19 pandemic, as its long-term effects on loan performance may only become evident over time. In addition, government interventions such as loan moratoriums during the pandemic may have temporarily suppressed the rise of NPLs, making empirical assessment more challenging. Therefore, further investigation is required to better understand the influence of these crises on NPL trends in Malaysia's banking sector.

Other than that, the majority of prior studies have analysed the influence of macroeconomic factors on NPLs in the banking industry. Nonetheless, there are only a limited number of studies examining NPLs in Malaysia, as many analyses concentrate on Western countries, thereby constraining the relevance of their findings to Malaysia's banking system. This trend is supported by numerous research studies conducted by Ahmed et al. (2021), Badar et al. (2013), Chaibi and Ftitit (2015), Chang et al. (2008), Ciukaj and Kil (2020), Gashi et al. (2022), Koju et al. (2018), Makri et al. (2014), Mazreku et al. (2018), Messai and Gallali (2019), Naili and Lahrichi (2022), Saba et al. (2012), and Singh et al. (2021). However, according to the study by Yusuf et al. (2021), there has been limited examination in Malaysia, particularly within the banking sector and specifically focusing on commercial banks. Therefore, more research is needed into the macroeconomic variables influencing NPLs in Malaysia's Conventional Banks.

Moreover, studies conducted in Malaysia frequently rely on limited datasets, focus on pre-pandemic periods, or omit certain macroeconomic variables. In several instances, variables such as exchange rates are excluded because researchers tend to

prioritise domestic macroeconomic indicators such as GDP, inflation, and unemployment, which are perceived to have a more direct impact on borrowers' repayment capacity. However, fluctuations in exchange rates may also indirectly influence loan repayment, particularly when businesses depend on international trade or hold liabilities denominated in foreign currencies. In addition, studies examining the relationship between exchange rates and NPLs remain limited and often focus on relatively short time periods. For example, Chaibi and Ftiti (2015) analysed 147 French and 133 German banks from 2005 to 2011. Similarly, Zain et al. (2020) examined Malaysian conventional banks from 2009 to 2018 and found a significant positive relationship between exchange rates and NPLs using data from eight local commercial banks.

Furthermore, this study emphasized the need to analyze the effect of macroeconomic factors on NPLs in Malaysia. Through an in-depth analysis of previous literature, the researcher identified that a thorough analysis of the macroeconomic variables with NPLs in Malaysia is still needed. While variables such as unemployment, inflation, and GDP have garnered significant attention in earlier research, generating varying results regarding their connection with NPLs, factors such as exchange rates and lending interest rates need more analysis. For example, studies by Mohamed et al. (2021), Naili and Lahrichi (2022), and Singh et al. (2021) show significant and positive correlations between these variables. In contrast, Anita et al. (2022) found a significant and negative relationship in their analysis. Meanwhile, some studies were insignificant, such as those conducted by Huan et al. (2020) and Zain et al. (2020). These conflicting results highlight the importance of thoroughly investigating Malaysia's conventional banks. In addition, as for the exchange rate, only a few significant studies have been conducted in Malaysia. For example, Kepli et al. (2021) showed no significant impact of the exchange rate with the NPLs. Therefore, this study will include the exchange rate to analyze, focusing only on Malaysia.

In conclusion, based on past studies and economic conditions, the rise of NPLs is a growing issue, given the experience of the unexpected crisis and previous studies. It also fills the literature gap by examining the relationship between macroeconomic variables while incorporating unexpected crises such as the GFC and the COVID-19 pandemic. Hence, including the current crises, this study is needed to determine whether this is related to macroeconomic factors in increasing the NPLs today. Importantly, this

research aims to expand existing literature by incorporating additional variables overlooked in previous studies within the Malaysian conventional banking sector. For example, the exchange rate since this variable has not been extensively explored in earlier studies, further analysis is necessary to understand its impact fully. Furthermore, the study endeavours to contribute to the field by analysing the effect of selected macroeconomic variables and unexpected crises, such as the GFC and the COVID-19 pandemic on NPLs.

1.3 Research Questions

This paper aimed to study the selected macroeconomic variables and the unexpected crises on the NPLs in Malaysian conventional banks. Thus, the researcher has outlined a few research questions below:

- a) What are the relationships between macroeconomic determinants (Unemployment Rate, GDPG, Inflation Rate, Lending Interest Rate, and Exchange Rate) towards NPLs among Malaysian conventional banks?
- b) How do the Unexpected Crises (GFC and COVID-19 Pandemic) impact NPL among Malaysian conventional banks?

1.4 Research Objectives

The main objective of this study is to investigate the relationship between macroeconomic factors and Unexpected Crises towards the NPLs. More specifically, this study's specific objectives are as follows:

- a) To investigate the relationship between macroeconomic determinants (Unemployment Rate, GDPG, Inflation Rate, Lending Interest Rate and Exchange Rate) towards NPLs among Malaysian conventional banks.
- b) To analyze the relationship between the Unexpected Crises (GFC and COVID-19 Pandemic) and NPL among Malaysian conventional banks.

1.5 Scope of Study

This study aims to determine the relationship between macroeconomic indicators and unexpected crises (independent variables) and NPLs (Dependent variable) in conventional Malaysian banks. The study will focus on a single country because much of the existing research is conducted in different countries, each facing distinct economic challenges. For instance, research by Anita et al. (2022), Kevin and Gyong (2020), Marouf and Guellil (2017), Messai and Gallali (2019), and Wairimu and Gitundu (2017) has explored these challenges in diverse global contexts, illustrating how each country's specific difficulties contribute to the broader understanding of the relationship between macroeconomic indicators and the unexpected crises towards the NPLs. Besides, focusing on a single Asian country, especially Malaysia, is crucial as many researchers predominantly concentrate on Western countries, such as the European regions. Also, the researcher wholly examines conventional banks, obtaining data from their income statements and balance sheets through their Annual Reports. In addition, the chosen timeframe spans 22 years, from 2002 to 2023, aligning with significant financial crises during that period, including the GFC from 2007 to 2008 and the COVID-19 pandemic crisis in 2019. The studies do not include the year of the Asian Financial Crisis because of data availability. Hence, the sample started in 2002, the post-crisis Asian Financial Crisis. Additionally, covering 22 years is essential as few studies cover this duration. Lastly, concerning variables, even though numerous economic indicators have been proven in past studies, this research focused only on variables categorized in macroeconomics, such as the Unemployment Rate, GDPG, Inflation Rate, Lending Interest Rate, and Exchange Rate. Therefore, the table below presents a list of 17 conventional banks, ranked by size, encompassing both local and foreign ownership. This inclusion is vital for the comprehensive analysis required in the study.

Table 1.4
List of Malaysian Conventional Banks

No.	Name	Ownership
1	Malayan Banking Berhad (Maybank)	Local
2	CIMB Bank Berhad	Local
3	Public Bank Berhad	Local
4	RHB Bank Berhad	Local

5	Hong Leong Bank Berhad	Local
6	Affin Bank Berhad	Local
7	Alliance Bank Malaysia Berhad	Local
8	AmBank (M) Berhad	Local
9	Citibank Berhad	Foreign
10	United Overseas Bank (Malaysia) Berhad	Foreign
11	Standard Chartered Bank Malaysia Berhad	Foreign
12	HSBC Bank Malaysia Berhad	Foreign
13	Bank of China (Malaysia) Berhad	Foreign
14	OCBC Bank (Malaysia) Berhad	Foreign
15	Bangkok Bank Berhad	Foreign
16	Bank of America Malaysia Berhad	Foreign
17	Deutsche Bank (Malaysia) Berhad	Foreign

Source: Bank Negara Malaysia (2024)

Table 1.4 shows 17 conventional banks in Malaysia, including local and foreign ownership. According to a BNM report in 2019, Malaysia has granted licenses for operating 27 conventional banks. However, the researcher removed J.P. Morgan Chase Bank Berhad from the sample in this study since their annual reports were missing for several years from 2013 to 2023. On the other hand, Sumitomo Mitsui Banking Corporation, Mizuho Corporate Bank Malaysia Berhad, Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad, BNP Paribas Malaysia Berhad, Industrial and Commercial Bank of China (Malaysia) Berhad, China Construction Bank (Malaysia) Berhad, and India International Bank Malaysia Berhad were all excluded from this study because they were established after 2002 and thus do not provide complete data across the study period. Besides that, the researcher removed the National Bank of Abu Dhabi Malaysia Berhad from the list because it stopped its Malaysian operations in 2018. Lastly, the Bank of Nova Scotia Berhad has also been excluded because it has decided to cease its operation in Malaysia on June 5, 2024. Hence, it would no longer be relevant to be included in this study, and even if it is included, the researcher could not obtain the data following the closure of its website.

1.6 Significance of Study

The findings of this study will offer individuals valuable knowledge and insight to help them achieve their objectives in the future. Besides that, it may enhance and provide improved loan management for banking systems. Hence, the findings of this study will provide significant advantages to the following:

1.6.1 The Malaysian Conventional Banks

Rising NPLs could impact banking efficiency, potentially contributing to a banking crisis. As a result, this study will assist Malaysian conventional banks in reducing NPLs in the future. For example, with the findings, the banks can retain credit exposure within proper and reasonable bounds, shielding them from cash flow losses. Besides, this study can also assist banking systems in improving their loan management system by facilitating better debt recovery and loan repayment systems. Furthermore, this study can be a helpful reference for banking systems for better strategic planning when facing future crises such as the GFC, and the COVID-19 pandemic.

1.6.2 Policymakers

A policymaker develops ideas and strategies in a business or government sector. Policymakers are also responsible for observing and analysing risks and developing a plan to control them. In this study, the BNM board of directors is the study's policymaker. They manage the bank's administration and operations and assess its success in carrying out its missions. For example, this study could help improve and guide the AKPK in guaranteeing its services to a greater sector of Malaysians. BNM established AKPK on 2 October 2006 to provide advisory services, counselling, and help to people in financial management and debt restructuring. In addition, the findings of this research can help improve policymakers' efforts to enhance the efficiency of Malaysia's banking sector by formulating a more detailed strategy to decrease loan defaults. For example, policymakers can use these findings to revise existing regulations or develop new strategies that promote greater financial system stability, transparency, and accountability, such as imposing stricter capital adequacy requirements on banks to

ensure sufficient reserves to withstand economic downturns and improve customer credit risk protection.

1.6.3 Body of Knowledge

This study could be helpful to students and future researchers as it can be used as part of their materials in the form of new features to compare the current work with the previous studies conducted. Besides, this study would help motivate them and act as a reference for them to conduct similar studies and contribute the findings to banking institutions. In addition, the results of this study could contribute to broadening awareness and understanding within this field of study. Also, this research could help validate and refine existing theories. The study will employ thorough analysis and testing to validate or improve existing banking and finance theory. For example, if the study's findings support the expectations of a specific economic theory or financial model, that theory's validity and applicability are strengthened.

1.7 Limitation of the Study

This study's limitations include its flaws or weaknesses, and the restraints put on the researchers while conducting this study. Therefore, the following are the study's limitations:

1.7.1 Focus of the study

The banking systems are categorised into two categories, which are conventional banks and Islamic banks. However, in these studies, the researcher focuses only on conventional banks, local and foreign-owned, due to the banks' different business natures. For example, Islamic financing adheres to Shariah Law derived from the Quran, Hadith, and Sunnah. The system deliberately refrains from engaging in interest-based transactions, known as Riba. Instead, it introduces the concept of purchasing an item on the borrower's behalf and selling it back to the borrower at a profit, referred to as Profit and Loss Sharing. In contrast to conventional financing, lenders provide loans to borrowers to profit from the interest charged on the initial loan amount. Besides that, the researcher would focus only on one country, Malaysia.

Therefore, the researcher may involve Islamic banks and other countries in future studies.

1.7.2 Data Constraint

Data sources are limited, and the researcher cannot obtain the required data. For example, when collecting data from reliable sources, the researcher may find that specific years of annual reports are missing. Also, in some cases, the data may not be accurate and reliable, or may have been blocked on the website, which prevented the researcher from obtaining the data. Therefore, it may result in the researcher failing to receive a good analysis. For example, conventional banks such as J.P. Morgan Chase Bank Berhad are excluded from the sample since their annual reports were missing for several years, from 2013 to 2023. Besides, the researcher cannot include several foreign banks because most were founded after 2002, which is not within the study period. Hence, the following banks are included were Sumitomo Mitsui Banking Corporation, Mizuho Corporate Bank Malaysia Berhad, Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad, BNP Paribas Malaysia Berhad, China Construction Bank (Malaysia) Berhad, India International Bank Malaysia Berhad, and lastly Industrial and Commercial Bank of China (Malaysia) Berhad. Also, the National Bank of Abu Dhabi Malaysia Berhad and the Bank of Nova Scotia Berhad had to be removed since they ceased operations in 2018 and June 2024, which hindered the researcher from obtaining consistent and up-to-date financial data.

1.7.3 Variables Constraint

Generally, there are two types of determinants of NPLs, which are macroeconomics (External factors) and bank-specific (Internal factors). However, in these studies, the researcher only focused on the macroeconomic variables influencing the NPLs in Malaysian conventional Banks. For example, the bank-specific factors are bank size, loan growth, and return on assets. The researcher only focused on the macroeconomic variables because a few banks' data is difficult to obtain as it is confidential and missing. Therefore, in some cases, the researcher cannot gain good data and information. Also, the researcher needs more time to collect the data if both determinants are included in the study. In addition, the researcher would use only

selected macroeconomic variables in these studies. For example, other macroeconomic variables, such as public debt, can still be used in this study, but the researchers excluded them due to a lack of data in Malaysia.

1.8 Research Structure

This study comprises five chapters, each focusing on essential elements. Chapter 1 covers the following topics: the background research, problem statement, study objectives, research questions, scope, limitations, significance, and the overall research structure. Moving to chapter two, the study delves into selected theories, explanations of independent and dependent variables, a comprehensive literature review, and identifies gaps in the existing literature. Next, Chapter three provides a detailed exploration of the research design and methodologies employed for data collection and analysis. Then, the discussion be continued in chapter four, in which the researcher discusses and interprets the findings of this study. Lastly, chapter five discusses the recommendations and conclusion of this study.

CHAPTER 2

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

In this chapter, the researcher thoroughly examines previous studies to gather insights into the relationship between Non-performing Loans (NPLs) and macroeconomic factors (Unemployment Rate, GDPG, Inflation Rate, Lending Interest Rate, and Exchange Rate) and unexpected crises (GFC and COVID-19 pandemic) in Malaysian conventional banks. This analysis is crucial for shaping the research structure, identifying gaps, and formulating hypotheses. Also, by focusing on the Malaysian context, the study aims to contribute to understanding this relationship within the country's specific economic and banking environment. The concise review highlights, key findings, methodologies, and limitations from relevant literature, aiding in developing a robust research framework.

2.2 Theory of Study

In this study, the researcher provides three fundamental theories to support the study, which are the Life Cycle Consumption Theory, Financial Accelerator Theory, and Deflation Theory. First, the Life Cycle Consumption Theory helps explain how individual financial planning and repayment patterns are influenced by life events such as employment status. For example, an increase in unemployment affects income flow and long-term financial planning, which can hinder borrowers' capacity to pay credit commitments, resulting in increased NPLs. On the other hand, the Financial Accelerator Theory provides a broader macroeconomic perspective by illustrating how adverse economic shocks including GDP contractions, lending interest rates, inflation, and unexpected crises like the GFC and the COVID-19 pandemic can weaken borrowers' balance sheets and increase credit market challenges resulting in increased loan defaults. Lastly, the Deflation Theory is employed to support the function of the exchange rate, where currency depreciation may increase the burden of foreign-denominated loans and import expenses, thereby reducing borrowers' repayment capabilities. Overall, these theories give a whole framework through which the

connection between macroeconomic concerns and NPLs may be better understood. Therefore, the following theory is described:

2.2.1 Financial Accelerator Theory

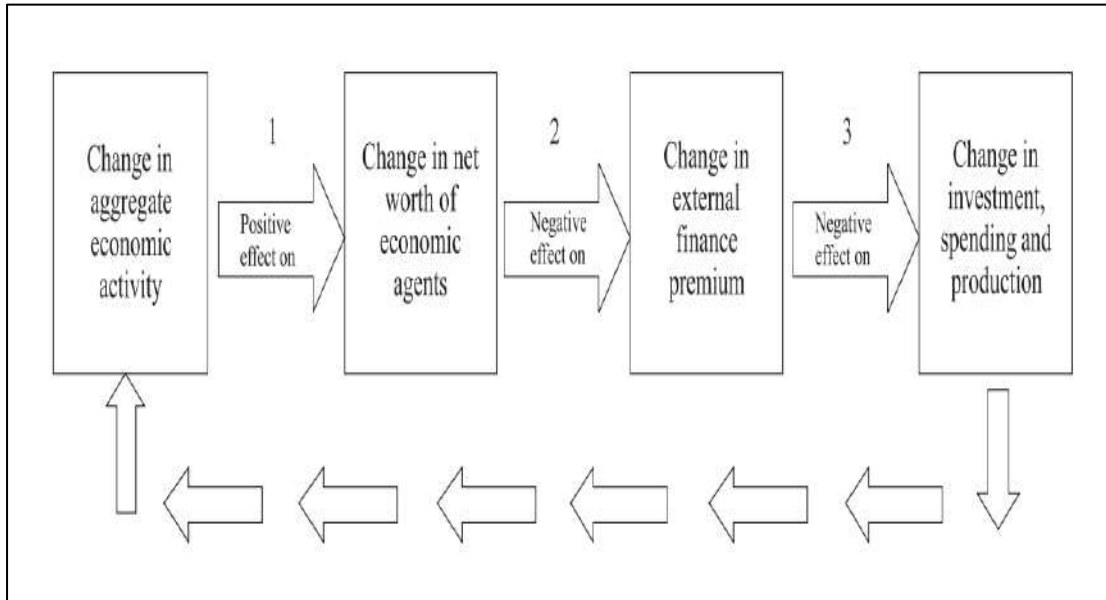


Figure 2.1 The Financial Accelerator Theory

Source: Adopted from Ćorić (2011)

Figure 2.1 shows the Financial Accelerator Theory developed by Bernanke and Gertler in 1989. This theory is applied to describe the relationship between macroeconomic variables, which are Gross Domestic Product Growth, Lending Interest Rate, and Inflation Rate, as well as the Unexpected Crises that are the GFC and the COVID-19 Pandemic, towards the NPL. Also, this theory can be explained as a process by which adverse shocks or changes in economic conditions can impact the NPLs.

Firstly, based on the figure presented above, Arrow 1 indicates that when the economy is stable or increases, individuals and businesses will become more financially stable, leading to a positive effect in the above figure. Then, Arrow 2 tells us that when people and companies are more affluent, they do not need to borrow as much money, so the cost of borrowing (external finance premium) decreases. Next, Arrow 3 shows that when borrowing costs are lower, people and businesses are more likely to invest in things like new projects or expansion, which leads to further economic growth in Arrow 4. Thus, rapid economic development is frequently associated with greater inflation rates due to increasing demand for products and services. Also, banks may extend more

loans during these periods, even riskier ones, thereby increasing the number of NPLs if borrowers fail to repay.

Other than that, to reduce inflationary pressures, BNM frequently implements monetary policy instruments, including an increase in the OPR. This measure increases the cost of borrowing and is intended to decrease investment and expenditure. Nevertheless, this policy has the potential to stabilize prices. However, it may also result in an increase in the cost of existing and prospective loans, which could place additional stress on borrowers. Consequently, certain businesses and individuals may encounter difficulty in fulfilling their debt obligations, which can lead to an increase in NPLs. Hence, while a decrease in inflation is typically considered advantageous, it does not necessarily result in a decrease in NPLs. Depending on the broader economic context, this complex relationship can be either positive or negative. For example, if inflation decreases as a result of tighter monetary policy and weaker economic growth, NPLs may rise as a result of decreased income and profitability. On the other hand, if inflation decreases progressively while the economy remains stable or improves, NPLs may decrease as borrowers are more adept at managing their debt. Therefore, the relationship between inflation and NPLs is not straightforward and necessitates an analysis that is contingent upon the economic conditions and the specific policy measures that are in effect. Also, financial institutions have the potential to impose higher interest rates on those with lower incomes, thus worsening the likelihood of loan defaults. In the Malaysian context, changes in the OPR set by BNM have a direct influence on lending interest rates. An increase in the OPR boosts borrowing rates, which may diminish customers' repayment capabilities and thus lead to increased NPLs. In general, changes in large-scale economic factors impact the financial stability of individuals, particularly those who are more susceptible, which in turn affects the levels of NPLs in the economy.

Besides, the accelerator theory argues that inflation might affect NPL and the threat of loan repayment. High inflation may reduce borrowers' buying power and income, making debt servicing harder and potentially increasing NPLs. This investigation supports the theory proposed by Wairimu and Gitundu (2017), which states that the inflation rate may cause borrowers to default on loans or external financing, which would then lead to an increase in NPLs. Therefore, it shows that from this theory, the inflation rate and NPL are significant and positively influence the NPL. Also, this study is supported by the study conducted by Naili and Lahrichi (2022), which

conveys that when Inflation results in a rapid rise in costs relative to income, makes it more challenging for consumers to meet their financial responsibilities, such as loan repayments. This issue ultimately leads to a higher likelihood of loan defaults, reducing the quality of bank loans and raising financial risks for the banks. In addition, SMEs are particularly sensitive to inflationary pressures due to their modest financial buffers and reliance on steady income. When inflation rises, the cost of inputs increases, decreasing profit margins and making it more difficult for SMEs to meet their financial responsibilities. This typically leads to an increase in NPLs as SMEs struggle to pay debt, resulting in a higher risk of defaults. Therefore, inflation can have an exaggerated impact on SMEs, causing their financial difficulties and contributing to the growth in NPLs. On the other hand, the study conducted by Anita et al. (2022) showed that the relationship between NPLs and Inflation is negative because inflation could lower the actual value of current debt, hence helping loan repayment for borrowers, especially if their income reacts to inflation. Despite such varied findings, this analysis takes the view aligned with the Financial Accelerator Theory and supported by a majority of empirical evidence that inflation has a positive connection with NPLs.

Moreover, this theory looks specifically at how changes in financial conditions increase volatility in the real economy. It demonstrates that during periods of economic growth, when the GDP rises, borrowing expenses fall, resulting in increased investment and total economic expansion. On the other side, when the economy is contracting, rising interest rates may worsen the downturn, leading to higher rates of loan defaults, particularly NPLs. The Financial Accelerator Theory emphasises the role of economic conditions, financial markets, and the real economy in determining the emergence of NPLs. In terms of the relationship between GDP and NPLs, the financial accelerator theory indicated a negative (inverse) result in their analysis. When GDP falls or grows at a negative rate, it indicates an economic contraction or recession. In such cases, firms may struggle to generate revenue, resulting in layoffs and lower consumer spending. The present economic downturn due to COVID-19 may lead to an increase in loan defaults as borrowers struggle to repay obligations, increasing the number of NPLs in the banking industry. In contrast, during periods of economic expansion or positive GDP growth, firms thrive, employment rates rise, and consumers have more disposable income. As a result, borrowers are in a better position to meet their financial obligations, resulting in fewer NPLs. The study by Messai and Jouini (2013) supported the inverse relationship between GDP and NPLs, indicating that NPLs

decrease during periods of economic prosperity due to stable incomes and revenues. Similarly, studies conducted by Klein (2013) suggested that higher GDP growth rates are linked to improved debt servicing capabilities owing to increased income levels. As a result, the Financial Accelerator Theory argues that there is a negative relationship between GDP and NPLs. This indicates that when the economy is poor, NPLs tend to rise, and when it is resilient, NPLs tend to fall.

Furthermore, Wairimu and Gitundu (2017) stated that this theory strives to clarify how economic issues like the GFC, as well as the COVID-19 pandemic, have a big effect on how businesses lend and borrow money. This crisis is considered a significant shock in which this theory also argues that when the economy is unstable, borrowers might not be able to get loans, and there is an increased likelihood that they will not pay back their loans or get additional financing. As a result, the financial accelerator theory suggests that Unexpected Crises are strongly and positively linked to NPL. It means that when difficulties occur the NPL in banks tends to go upwards.

In conclusion, the financial accelerator theory argues that the macroeconomic determinants, such as the Inflation rate and unexpected crises such as the GFC and the COVID-19 pandemic could show positive and significant results in analysis. Meanwhile, the relationship between GDP and NPL is significant and negative. In other words, it is consistent with the literature shown to influence the NPLs (Castro, 2013; Ciukaj & Kil, 2020; Mohamed et al., 2021; Mustafa & Ali, 2019; Naili & Lahrichi, 2022; Singh et al., 2021; Zainol et al., 2018; Zulkifli & Ahmad, 2022a). Therefore, the financial accelerator theory is of utmost importance in determining the framework and objectives for the study. This analysis provides a comprehensive comprehension of the macroeconomic factors that influence the number of NPLs, including GDPG, Lending Interest Rates, inflation, and unexpected crises such as Global Financial Crisis and the COVID-19 pandemic.

2.2.2 Deflation Theory

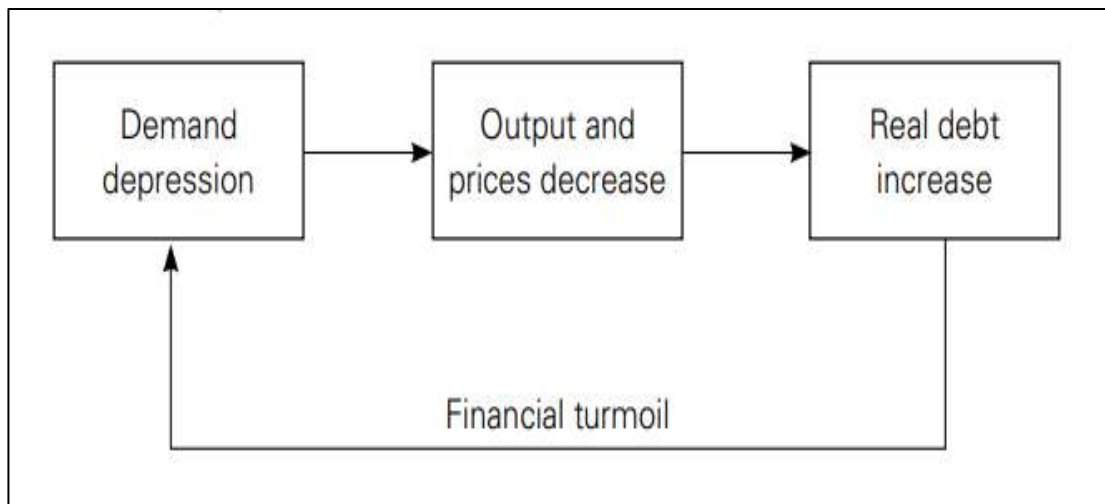


Figure 2.2 The Deflation Theory
Source: Adopted from Asensio (2018)

Figure 2.2 shows the deflation theory. This underpinning theory was developed by Fisher in 1934 and described the relationship between NPL and the Exchange rate. Besides that, this deflation theory is related to a fall in prices, making it harder for people to pay back their loans. Businesses and people can have less income because of Deflation, which can make it harder for them to pay their expenses. Consequently, borrowers may be less likely to repay their loans, which causes NPLs to rise. Also, deflation can affect exchange rates in many ways, such as influencing interest rates, investor sentiment, and the way trade works. Therefore, changes in the exchange rate can affect people who have loans in a foreign currency. If the value of the domestic currency drops significantly, individuals who have borrowed money in a foreign currency may have to pay back more in their currency, which raises the risk of failure and directly influences the NPLs to rise.

Besides that, a previous study conducted by Wairimu and Gitundu (2017) applied the deflation theory in their study. As a result, their study shows that the relationship between NPLs and exchange rates is significant. The study stated that a depreciation of the country's currency (indicated by an increase in the exchange rate) was associated with higher import costs, which may have increased financial stress for traders, businesses, and NPLs. This theory is also supported by the empirical studies conducted by Sirpal (2009) on payment methods and foreign exchange risk management among Brunei companies, in which these indicators should indicate a

positive direction. This is because when the home country's currency weakens, increasing the exchange rate means it takes more local currency to buy foreign currencies. As a result, the cost of imported goods rises. When this happens, local products become cheaper, boosting exports but making imports more expensive. This challenges local customer retention as the prices of locally sold products increase. Also, according to Sirpal (2009), as the local currency depreciates, it strains the financial system. The increased costs of imported inputs can stress the financial letter of credit issued by banks to traders, elevating the risk of defaults.

In conclusion, this theory implies that the relationship between the exchange rate and NPL is positive and significant. It indicates that a rise in the exchange rate may contribute to the increase in NPLs in banks. Besides, deflation theory sheds light on how falling prices and economic contraction impact borrowing behaviour, loan repayment capacity, and the overall financial stability of both borrowers and lenders. This theory is useful in the context of studying NPLs and their determinants.

2.2.3 Life Cycle Consumption Theory

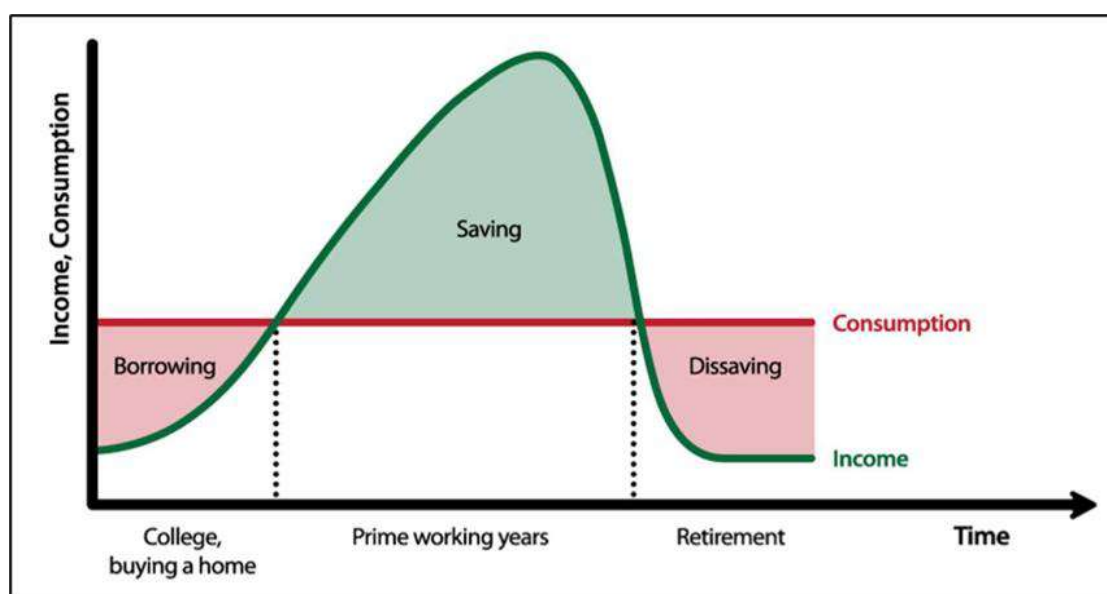


Figure 2.3 The Life Cycle Consumption Theory
Source: Adopted from Stasinopoulos (2015)

Figure 2.3 illustrates the Life Cycle Consumption theory. The life cycle consumption theory, developed by Franco Modigliani and his colleagues in the 1950s, is an established economic theory that has a significant impact on how economists see consumer behaviour throughout time. According to the theory, to maintain a stable

standard of living, individuals manage their consumption and savings behaviour across different stages of life, which often involves saving during their working years and dissaving after retirement. Over time, this fundamental theory has been expanded and modified to include more realistic assumptions such as income volatility, borrowing limits, and behavioural concerns. These changes make the theory particularly useful in studying long-term financial stability and its relationship to NPLs, as they assist in explaining how customers may struggle with debt commitments during unemployment. According to Browning and Crossley (2001), the Life-Cycle theory is widely acknowledged among scholars as the standard framework for understanding the inter-temporal distribution of time, effort, and money in economics.

Besides that, the life cycle theory divides the life of a working employee into three stages: youth, middle, and old age. For example, in youth, individuals consume and spend a lot. Hence, they earn more and like to take loans to maintain their lifestyle, so sometimes their expenditure exceeds their income, and their saving become negative. As shown in the figure above, when no fixed income is earned during the early years, an individual would have to borrow to fulfil needs such as financing their studies or buying a home (Stasinopoulos, 2015). Thus, since borrowers' income is inadequate to cover their loan obligations, this problem develops, particularly in times of crisis like the current COVID-19 Pandemic. Meanwhile, throughout the Middle Ages, families needed to establish a secure financial foundation. Their revenue grew, but their costs did not. Once people reach their working life years, they can get a regular salary and accumulate money for future goals such as paying off debt or funding their retirement. However, some borrowers, notably those with families, will have increased commitment requirements beyond the borrower's income. According to the study by Xiao and Yao (2014), younger households are more financially distressed than their older counterparts, and the presence of children increases the likelihood of delinquency. For example, Malaysia is one of the Asian countries with the highest household debt, which is 68% (Chantararat et al. 2020). As for old age, the income becomes zero, and dependency on pension and savings increases. Thus, in this concept, compared to middle-aged individuals, younger borrowers are likely to face more financial constraints (Attanasio & Weber, 2010). For example, during tough times, people may need to earn more money and have valuable assets to be able to get loans.

The life cycle consumption theory states that macroeconomic variables, such as the unemployment rate, are significantly and positively associated with NPL. According to Messai and Jouini (2013), the positive result comes from lower-income and jobless customers who had trouble keeping obligations and paying back loans because the unemployment rate or income affected their households' cash flow and debt burdens. Besides that, a previous study conducted by Wairimu and Gitundu (2017) showed that the researcher applied the life cycle consumption theory on the relationship between the Unemployment rate and NPLs. According to the researcher, the life-cycle consumption theory proposes that individuals strategically manage their spending and saving habits throughout their lives to sustain consistent lifestyles. This indicates a pattern of maintaining stable amounts of consumption over a period of time rather than experiencing drastic changes. Simply stated, the theory shows that individuals strive to equalize their consuming habits across their lifetimes. They strive to maintain a generally stable level of expenditure, gradually adapting it to variations in their circumstances, such as changes in income, family size, or life stage. However, various factors such as income volatility and behavioural concerns exert influence on individuals' financial habits, hence affecting their capacity to repay debts. In addition, the research carried out by Lawrence (1995) revealed that individuals with limited earnings exhibit higher rates of loan default as a result of increased vulnerability to joblessness and difficulties in fulfilling loan responsibilities.

2.3 Review of Previous Study

2.3.1 Non-Performing Loans

NPLs are an ongoing issue for all banks. The unemployment rate, GDPG, Inflation Rate, Lending Interest Rate, and Exchange Rate all affect the growth of NPLs. This is particularly relevant during financial turmoil like the GFC, and the recent COVID-19 pandemic. Also, researchers have used NPL as an essential indicator to measure credit risk in banking systems in past years, and previous studies have emphasized how important these macroeconomic factors are in determining NPL levels. Hence, a few studies that looked at the relationship between NPLs and macroeconomic factors are those study conducted by Anita et al. (2022), Castro (2013), Gashi et al. (2022), Kepli et al. (2021), Kevin and Gyong (2020), Marouf and Guellil (2017),

Mohamed et al. (2021), Mustafa and Ali (2019), Osunkoya et al. (2023), Pandey (2024), Saba et al. (2012), Skarica (2014), Vaicondam et al. (2019), Wairimu and Gitundu (2017), and Zainol et al. (2018). Also, the implication of unexpected crises in this study plays an important role in understanding the impact on the NPL as well as the whole banking system. In addition, Anita et al. (2022) emphasize that an increase in NPLs is a significant indicator of increased credit risk. Since NPLs directly affect the overall soundness of the financial system, addressing them is vital. Among the several risks faced by banks, credit risk is frequently the most fatal due to its enormous effect on profitability.

2.3.2 Macroeconomic Determinants

The selections of macroeconomic variables in this study the unemployment rate, GDP growth, Inflation rate, Lending Interest rate, and Exchange rate are built on their significant theoretical and empirical value in determining NPLs. Increased unemployment rates raise financial distress among borrowers, resulting in increased default risks, as discovered by Castro (2013). Meanwhile, a drop in GDP growth suggests economic recession, decreasing business profitability and household purchasing power, which Klein (2013) and recent research by Zainol et al. (2018) showed to be related to growing NPLs. Also, Inflation influences loan repayment capacity, where overbearing inflation can erode real salaries and increase default risks, as underlined by Kepli et al. (2021). Similarly, changes in lending rates influence debt service difficulties, with Espinoza and Prasad (2010) and Zulkifli and Ahmad (2022a) associating higher interest rates with greater loan defaults. Lastly, exchange rate depreciation boosts the cost of foreign-denominated debt, further stressing borrowers, as proven by Ari et al. (2021) and Castro (2013).

2.3.2.1 NPL and Unemployment Rate

The World Bank defined the unemployment rate as the percentage of the population that is neither employed nor actively looking for employment. The study conducted by Messai and Jouini (2013) used a Panel Regression model to found that NPLs were positively and significantly correlated with the unemployment rate. The researcher focused on the period from 2004–2008 on 85 banks in Spain, Greece, and

Italy when the subprime mortgage and debt crisis arose. Also, the researcher stated that the positive result comes from jobless customers who had trouble keeping obligations and paying back loans because the unemployment rate affected their households' cash flow and debt burdens.

Next, Kartikasary et al. (2020) conducted a study using SPSS (Statistical Package for the Social Sciences) software to examine the data. As a result, they found a strong and negative connection between Indonesia's unemployment rate and NPLs. In contrast, Klein (2013), who used Panel Vector Auto-Regression (VAR) analysis with STATA software, found a positive correlation between NPLs and the unemployment rate in Central, Eastern, and South-Eastern Europe. In addition, this study is supported by the study conducted by Messai and Gallali (2019), which found a strong and positive correlation between NPLs and the unemployment rate in European countries from 2000 to 2011. Hence, a constant positive association was seen over the studied time as it shows that people may have trouble meeting their financial responsibilities when they lose their jobs.

Besides that, Castro (2013) study also found a strong positive correlation between NPLs and unemployment. The study examines data from five countries—Greece, Ireland, Portugal, Spain, and Italy—from the first quarter of 1997 to the third quarter of 2011. It used ordinary least squares (OLS), fixed effects, and random effects models. The selection of these countries was based on the state of their economies and finances were after the previous financial crisis, which put a lot of stress on their banks. On the other hand, further research by Huan et al. (2020), Kozarić and Delihodić (2020), Mazreku et al. (2018), and Skarica (2014) supported this finding. Using OLS to conduct the analysis these studies constantly show a significant and positive correlation between NPLs and the unemployment rate. Also, the study by Huan et al. (2020) also suggested that high unemployment means there are more people without jobs, which makes credit risk higher because they do not have a steady income to pay their debts. Other than that, Marouf and Guellil (2017) study, found that NPLs and the unemployment rate did not affect the Algerian banking system from 1980 to 2014.

Moreover, Makri et al. (2014) also used dynamic panel regression. This study also found a positive correlation between unemployment and banks' NPLs. The researcher stated that lack of employment makes it harder for borrowers to pay their loan payments and makes debtors more likely to have trouble paying their debt obligations. The studies conducted by Chaibi and Ftiti (2015), Kjosevski and Petkovski

(2021), Koju et al. (2020), and Naili and Lahrichi (2022) all revealed a significant and positive association between NPLs and unemployment using the same model. Meanwhile, the study by Radivojevic and Jovovic (2017) used static and dynamic models in an unbalanced panel and found a positive impact on NPLs. Also, using the static panel approach, Ciukaj and Kil (2020) found a positive correlation between NPLs and the Unemployment Rate. Thus, the consistent findings from various research using the same models (Panel Regression) highlight the constant result between economic variables (unemployment rates) and NPL fluctuations.

Furthermore, Kevin and Gyong's (2020) analysis found that NPLs and the unemployment rate are insignificant in the long term. However, in the short run, the study is significant and negatively impacts the NPLs. This study was conducted by employing the Autoregressive Distributed Lag (ARDL) model in their research based on Nigerian banks. Meanwhile, other studies using the same model in their research, such as Golitsis et al. (2022) and Mustafa and Ali (2019), showed a significant and positive relationship towards the NPLs. According to the study by Mustafa and Ali (2019), the unemployment rate did not affect the NPLs in the short run. However, unemployment showed a significantly positive sign towards the NPLs in the long run. Besides, the researcher indicates that an economy facing recession results in losing income sources for borrowers, eventually increasing the inability to repay debt.

On the other hand, using a simple linear regression model on SPSS software in Malaysia, a study conducted by Vaicondam et al. (2019) also found that NPLs and the unemployment rate have a strong relationship in the banking sector. These studies were conducted in Malaysia, focusing on the period from 2009 to 2018. Therefore, this study shows that when the joblessness rate increased by 1 unit, NPLs increased by 48.8%. The researcher stated in this study that unemployed customers may need greater financial capacity to repay their loans. Hence, this leads to an increase in NPLs. Also, the study by Wairimu and Gitundu (2017) showed a positive and significant relationship with the NPLs in Kenya's banking system. Hence, this study is supported and justified by the life cycle consumption theory, in which the unemployment rate positively affects individuals' income, increasing their debt burden. In addition, individuals or borrowers may have to pay higher interest rates because banks see them as risky borrowers. This is because they are more likely to lose their jobs and not be able to pay back their loans.

Next, the study by Mohamed et al. (2021), utilizing multiple regression analysis, revealed a significant negative relationship between NPLs in the Malaysian

banking industry. The research employed monthly secondary data from 2015 to 2019, collected from financial statements and DataStream. As a result, in this study, the researcher suggested that future studies might benefit from incorporating various data frequencies, such as yearly, quarterly, or weekly, to enhance the sensitivity of the analysis. This finding aligns with the results of the Nargis et al. (2019) study, which also demonstrated a negative relationship between NPLs and unemployment using multiple regression analysis with EViews-9 (Econometric Views, Version 9). Similarly, Gashi et al. (2022) employed the Generalized Method of Moments (GMM) and fixed and random models. They found a negative and significant association between the NPL rate and unemployment in the Western Balkans from 2000 to 2019. Hence, although the study did not explicitly articulate the rationale behind the analysis, a common interpretation is that during economic downturns, rising unemployment may lead individuals and businesses to borrow cautiously or prioritize loan repayments, thereby reducing NPLs despite economic challenges. This prudent borrowing behaviour contributes to the negative relationship between NPLs and unemployment. Despite that, Petkovski et al. (2021) study, utilizing an unbalanced dataset and employing GMM, fixed, and random models, revealed a positive and significant impact on NPLs in Polish commercial banks.

Lastly, the study conducted by Sing et al. (2024) showed positive and significant results towards the NPL in Malaysia. Although this study focuses on the NPL in residential property for both commercial and Islamic banks in Malaysia. It states that lower unemployment rates are linked to a decrease in the NPL. Therefore, below is the summary of the previous study that analyses the relationship between the Unemployment rate and NPLs:

Table 2.1
Summary of Empirical Works and Directional Impact of Unemployment Rate

Independent Variable	Directional Impact	Previous Studies
Unemployment Rate	Positive Correlation (+)	Castro (2013), Chaibi and Ftiti (2015), Ciukaj and Kil (2020), Golitsis et al. (2022), Huan et al. (2020), Kjosevski and Petkovski (2021), Klein (2013), Koju et al. (2020), Kozarić and Delihodić (2020), Makri et al. (2014), Mazreku et al. (2018), Messai and Gallali

		(2019), Messai and Jouini (2013), Mustafa and Ali (2019), Naili and Lahrichi (2022), Petkovski et al. (2021), Radivojevic and Jovovic (2017), Sing et al. (2024) Skarica (2014), Vaicondam et al. (2019), and Wairimu and Gitundu (2017).
Unemployment Rate	Negative Correlation (-)	Gashi et al. (2022), Kartikasary et al. (2020), Kevin and Gyong (2020), Mohamed et al. (2021), and Nargis et al. (2019).
Unemployment Rate	Not Significant	Kevin and Gyong (2020), Marouf and Guellil (2017), and Mustafa and Ali (2019).

2.3.2.2 NPL and Gross Domestic Product

Leamer (2009) defined Gross Domestic Product (GDP) as the market value of all final products and services produced within a defined geographical region. This economic indicator is crucial for assessing a country's economic stability and financial well-being. Leamer states that the relationship between NPLs and GDP is significant and characterized by negative coefficients. In addition, when the GDP grows, signalling a strong and prosperous economy (unless hindered by poor economic growth), it improves the living standards of borrowers. This positive shift in living conditions, in turn, makes it easier for individuals to repay their loans. This shows the connection between a nation's economic health and the likelihood of borrowers successfully repaying their loans. Also, a consistent trend is observed in numerous studies, all pointing to a significant and negative correlation with NPLs. For instance, studies by Anita et al. (2022), Castro (2013), Kozarić and Delihodić (2020), Marouf and Guellil (2017), Mazreku et al. (2018), Saba et al. (2012), and Skarica (2014) have consistently found this negative association. It is also important to note that OLS is used as the statistical method in all of these studies.

Besides that, Skarica's (2014) analysis of seven Central and Eastern European (CEE) nations highlighted the relationship between NPLs and GDP. In this

study, the results reveal that the NPL is negatively affected by GDP growth shifts. However, a slowdown in economic activity is directly related to a rise in the NPL ratio, emphasising the connectivity between a region's GDP and financial sector soundness. Also, Marouf and Guellil (2017) identified a negative correlation between NPL and GDP in the Algerian banking sector, as the researchers stated that economic booms allow borrowers to repay their loans more quickly, resulting in fewer NPLs. On the other hand, Mazreku et al. (2018) also found that GDP growth boosts disposable income and allows individuals to settle their loans.

Next, the study by Anita et al. (2022) uncovered a significant negative correlation between NPLs in SAARC countries (Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan, and Sri Lanka) from 2008 to 2019. Economic growth improves business performance and enhances payment capacity, thus reducing NPLs. Meanwhile, during economic downturns, the decline in borrower income and collateral values reduces their ability to pay, contributing to an increase in NPLs. On the other hand, the study by Mahyoub and Said (2021), which used the OLS with a Balanced panel, shows an insignificant impact of GDP on NPLs. However, Chang et al.'s (2008), study showed a positive and significant relationship between NPLs and GDP. Using a dynamic regression and fixed effect model (Semi-Variable) to investigate the relationship from 2000 to 2005, the study identifies a positive correlation. The authors suggest that during the expansion phase of the economic cycle in the Brazilian banking sector, banks tend to take on greater risk by increasing the loans they offer. This increase in risky lending that can potentially reduce overall loan quality, increasing the NPLs. In this situation, specific economic indicators such as GDP and NPLs have a positive association, which means they both rise simultaneously. In other words, the boom phase encourages aggressive lending practices, which might briefly enhance GDP due to increased economic activity, leading to more loan defaults. Also, this study is supported by the study conducted by Kartikasary et al. (2019), which analyzed the positive relationship between GDP and NPLs in the Indonesian banking sector from 2014 to 2017 using a Panel data Regression model. In addition, findings from studies by Gashi et al. (2022) and Singh et al. (2021) also affirmed this positive association between GDP and NPLs.

Moreover, other studies like Zulkifli and Ahmad (2022a) showed that the relationship between NPL and GDP is insignificant in Malaysian commercial banks,

even though it shows a negative sign. Employing panel static analysis of the Random Effect Model from 26 commercial banks from 2007 to 2020, it stated that GDP does not contribute to significant changes towards the NPL in Malaysian commercial banks. The studies were also supported by the study of Badar et al. (2013), Nargis et al. (2019), and Zain et al. (2020), who also found insignificant results between variables. Meanwhile, studies like Kevin and Gyong (2020) employed the ARDL to estimate the short and long-run analysis from 1998 to 2020 in the Nigerian banking sector. Therefore, this study showed that these variables only resulted in significant and negative results in the short run. Meanwhile, it shows an insignificant and negative result in the Nigerian Banking Sector in the long run.

Also, according to the study by Wairimu and Gitundu (2017) found a positive but statistically insignificant relationship between economic growth and debt repayment, suggesting that economic growth may not always lead to better debt repayment. In this study, the researcher mentions that the data challenge the idea that when the economy grows, people automatically become better at repaying their debts. Contrary to expectations, the data revealed that economic growth did not consistently lead into better debt repayment rates. Another study conducted by Sun and Purwanto (2021) employed Multiple Linear Regression on EViews-10 (Econometric Views, Version 10) in Chinese commercial banks and showed a negative and insignificant association between GDP and NPLs.

In addition, Chaibi and Ftit (2015) showed a negative association between NPL ratios in both economies. The slowed development in French and German growth worsens the NPL ratio. The author also suggested that the GDP growth impact is particularly important for French NPLs since it shows their ability to repay loans throughout the current economic cycle. Other studies, such as Kjosevski and Petkovski (2021), Klein (2013), Koju et al. (2020), Makri et al. (2014), and Naili and Lahrichi (2022), which used dynamic panel regression revealed a negative and significant outcome in their analysis. In addition, studies by Messai and Jouini (2013) and Koju et al. (2018) utilizing panel regression also identify a negative correlation between variables. Contrary to these findings, Ciukaj and Kil (2020) employed a static Panel Model and report similar negative results. The study concentrated on EU member state banks with high NPL levels in 2017, including Bulgaria, Croatia, Cyprus, Italy, Ireland, Greece, and Portugal. The panel data covered 629 banks operating continuously from

2011 to 2017. Also, the study conducted by Sing et al. (2024) which used ARDL and Error Correction Regression Results in their analysis found similar negative results. Overall, regardless of whether the analysis is static or dynamic, these studies consistently demonstrate that GDP has a negative impact on loan repayments, as evidenced by the coefficients derived from panel regression analysis.

Furthermore, Golitsis et al. (2022) found a negative and significant association in both the short and long-term using the ARDL model. Also, the study's time frame covers from the first quarter of 2005 to the second quarter of 2022, which includes major financial crises such as the GFC, the European Sovereign Debt Crisis, the Pandemic COVID-19 pandemic era, and the Russian invasion of Ukraine. Besides that, the study by Zainol et al. (2018) supported this statement. The study discovered a strong negative correlation between NPL and GDP. The ARDL method was also used in these works on a set of time series data in Malaysia from Q12006 to Q42015, collected every three months. These studies have always found a significant correlation between NPLs and GDP, which is negative. This relationship indicates that as the economy improves, people can pay back their debts more quickly because they will make more money. Also, studies using the ARDL model like the one conducted by Mustafa and Ali (2019) showed that GDP negatively and significantly affects NPLs.

Lastly, Lee et al. (2022) discovered GDP's significant and negative influence on NPLs. The research utilised non-linear least squares analysis on a panel dataset of 32 publicly listed Taiwanese companies from 2008 to 2015. According to the author when the economy is weak lending by banks is often plagued with uncertainty regarding the ability to repay, primarily due to the significant earnings volatility in the industry, which in this study is earnings volatility of the construction industry. This finding is supported by Mensah and Adjei (2015), who employed simplified linear regression and revealed a significant and negative correlation with the NPLs. In addition, the study by Ahmed et al. (2021) and Petkovski et al. (2021) also discovered a negative and significant effect on NPLs. Therefore, below is the summary of the previous study that analyzes the relationship between GDP and NPLs:

Table 2.2

Summary of Empirical Works and Directional Impact of GDP

Independent Variable	Directional Impact	Previous Studies
Gross Domestic Product	Positive Correlation (+)	Chang et al. (2008), Gashi et al. (2022), Kartikasary et al. (2020), and Singh et al. (2021).
Gross Domestic Product	Negative Correlation (-)	Ahmed et al. (2021), Anita et al. (2022), Castro (2013), Chaibi and Ftiti (2015), Ciukaj and Kil (2020), Golitsis et al. (2022), Kevin and Gyong (2020), Kjosevski and Petkovski (2021), Klein (2013), Koju et al. (2018), Koju et al. (2020), Kozarić and Delihodić (2020), Leamer (2009), Lee et al. (2022), Makri et al. (2014), Marouf and Guellil (2017), Mazreku et al. (2018), Mensah and Adjei (2015), Messai and Jouini (2013), Mustafa and Ali (2019), Naili and Lahrichi (2022), Petkovski et al. (2021), Saba et al. (2012), Sing et al. (2024), Skarica (2014), and Zainol et al. (2018).
Gross Domestic Product	Not Significant	Badar et al. (2013), Kevin and Gyong (2020), Mahyoub and Said (2021), Nargis et al. (2019), Sun and Purwanto (2021), Wairimu and Gitundu (2017), Zain et al. (2020), and Zulkifli and Ahmad (2022a)

2.3.2.3 NPL and Inflation Rate

The International Monetary Fund defines inflation as a price rise over time. In this study, the researcher employed the Consumer Price Index (CPI) as a proxy for inflation, which monitors changes in consumer goods and services. The CPI is widely acknowledged as an indicator of inflation since it reflects the rise in the prices of goods and services that most consumers commonly buy. The researcher's objective in using

the CPI as a proxy for inflation was to accurately represent fluctuations in consumers' expenses related to their cost of living. This methodology enables a comprehensive analysis of inflationary pressures in the economy, providing crucial insights into the impact of price fluctuations on consumer purchasing power and overall economic stability.

Besides that, Mohamed et al. (2021) used multiple regression analysis on monthly secondary data from 2015 to 2019 in their research. Their findings demonstrate a direct relationship between the inflation rate and NPLs in Malaysia's banking sector. The positive correlation may be attributed to the increase in GDP, which signifies stability and expansion, resulting in greater availability of funds for expenditure. Nevertheless, when the cost-of-living rises, borrowers see a decline in purchasing power. This contributes to their ability to repay debts since it necessitates increased wealth. On the other hand, using multiple regression analysis, Singh et al. (2021) discovered a significant and positive correlation, yielding similar findings. However, the study conducted by Sun and Purwanto (2021) demonstrated a notable negative relationship between the inflation rate and NPLs. The research uses E-Views 10 and employs multiple linear regression to understand this association better.

Next, Studies by Naili and Lahrichi (2022) have shown a statistically significant association between inflation and NPLs. The authors used a dynamic panel estimation technique using the GMM to demonstrate that inflation presents a significant concern for banking regulators in growing nations within the Middle East and North Africa (MENA) area, mainly when wages exhibit stickiness, i.e., they do not increase swiftly in response to economic fluctuations. Inflation results in a rapid rise in costs relative to income, making it more challenging for consumers to meet their financial responsibilities, such as loan repayments. This issue ultimately leads to a higher likelihood of loan defaults, reducing the quality of bank loans and raising financial risks for the banks. Hence, the intricate relationship between stagnant salaries, inflation, and lending standards underscores the need for regulators and economic control to maintain financial stability in these domains. On the other hand, previous studies have used other statistical models such as Panel VAR, OLS, or Dynamic Panel models. Examples of such studies are Kjosevski and Petkovski (2021), Klein (2013), Koju et al. (2020), Kozarić and Delihodić (2020), Radivojevic and Jovovic (2017), and Skarica (2014). Thus, all of these analyses also show that the inflation rate is positively and statistically

significant for the NPLs.

Moreover, Gashi et al. (2022) found a significant and unexpected negative correlation between inflation and NPLs in the Western Balkans from 2000 to 2019. Contrary to the authors' assumptions of a positive association, the negative findings may be attributed to the increase in the interest rate to combat inflationary pressure, which makes borrowing more costly. In other words, this approach tries to slow the economy and keep inflation from skyrocketing and decreasing over time. As a result, while inflation is declining, borrowers may need help to repay their obligations, such as loans and mortgages, since they must pay higher interest rates. The study is supported by the results of Chaibi and Ftiti (2015), who identified a significant and negative correlation in Germany. Also, the research conducted by Anita et al. (2022) and Koju et al. (2018) has shown that the inflation rate has a negative effect on NPLs, which aligns with the results of the previous study. According to the authors' analysis, the reason for the negative results is that when inflation rises, the overall worth of loans decreases, hence facilitating borrowers to make punctual payments and decreasing the likelihood of default. In addition, research conducted by Mazreku et al. (2018), Mensah and Adjei (2015), and Nargis et al. (2019) has also shown a strong and statistically significant negative association with NPLs.

Furthermore, the study conducted by Kevin and Gyong (2020) revealed a positive and statistically significant correlation, although only in the short term. Nevertheless, the study's results did not demonstrate statistical significance over an extended period. The researchers used the ARDL model to analyze the correlation between inflation and NPLs in Nigeria's banking sector from 1998 to 2020. Other than that, the investigation conducted by Badar et al. (2013) revealed no statistically significant outcomes in either the long term or the short term. However, it shows a positive association between NPLs and inflation rates in Pakistan during periods of economic instability in the long run. In contrast, Petkovski et al. (2021) reported non-significant findings when examining Polish commercial banks from 2005 to 2018. This result aligns with other prior studies, such as those conducted by Ciukaj and Kil (2020), Makri et al. (2014), and Wairimu and Gitundu (2017), which also revealed insignificant results in their analyses.

Lastly, considering the research carried out in Malaysia, various studies also indicated a non-significant result, such as the study by Mahyoub and Said (2021). The

study discovered no apparent association between the present economic condition and the NPLs based on data gathered from 2010 to 2018. In addition, Zain et al. (2020) discovered that there is no statistically significant correlation between NPLs and inflation. This study analyses data collected from eight Malaysian commercial banks during the period from 2009 to 2018. Also, the data has been analysed using a panel data technique implemented in STATA 14. Other than that, studies conducted by Huan et al. (2020), Mustafa and Ali (2019), Sing et al. (2024), Vaicondam et al. (2019), and Zainol et al. (2018) that employed OLS, Simple Linear Regression, or ARDL model in their study also show a non-significant result. Therefore, below is the summary of the previous study that analyzes the relationship between the Inflation rate and NPLs:

Table 2.3
Summary of Empirical Works and Directional Impact of Inflation Rate

Independent Variable	Directional Impact	Previous Studies
Inflation Rate	Positive Correlation (+)	Kevin and Gyong (2020), Kjosevski and Petkovski (2021), Klein (2013), Koju et al. (2020), Kozarić and Delihodić (2020), Mohamed et al. (2021), Naili and Lahrichi (2022), Radivojevic and Jovovic (2017), Singh et al. (2021), Skarica (2014), and Sun and Purwanto (2021).
Inflation Rate	Negative Correlation (-)	Anita et al. (2022), Chaibi and Ftiti (2015), Gashi et al. (2022), Koju et al. (2018), Mazreku et al. (2018), Mensah and Adjei (2015), and Nargis et al. (2019).
Inflation Rate	Not Significant	Badar et al. (2013), Ciukaj and Kil (2020), Huan et al. (2020), Kevin and Gyong (2020), Mahyoub and Said (2021), Makri et al. (2014), Mustafa and Ali (2019), Petkovski et al. (2021), Sing et al. (2024), Vaicondam et al. (2019), Wairimu and Gitundu (2017), Zain et al. (2020), and Zainol et al. (2018).

2.3.2.4 NPL and Lending Interest Rate

Lending rates are the interest banks charge borrowers for a specific time. The central bank, such as BNM, influences these rates but does not determine them. Instead, the central bank adjusts the OPR to affect lending rates. The OPR is the overnight bank lending rate. When the central bank alters the OPR, banks' borrowing costs change, affecting their lending rates. When the OPR rises, lending rates rise, raising borrowing costs. As a consequence, loans cost more and require more outstanding monthly payments. Also, a reduction in the OPR decreases borrowing costs for banks, generally resulting in lower lending rates, hence becoming loans more accessible. However, this may result in more risky borrowing, as individuals and organizations would be incentivized to incur more debt, potentially raising NPLs if borrowers' default on repayment obligations.

The study by Zainol et al. (2018) indicated a positive link between lending rates and NPLs. The researcher uses the ARDL method on data from Q12006 to 2015 to show that borrowing rates significantly affect the NPL. This is because if interest rates go up, borrowers will be less able to pay back the loans they have taken out. This study, along with the study conducted by Gashi et al. (2022), showed a connection between lending interest rates and NPLs in the Western Balkans. Econometric models like GMM, the fixed effect model, and the random effect model are used in the study. Other than that, its analysis is based on data from the World Bank for the Western Balkans from 2000 to 2019.

Besides that, Vaicondam et al. (2019) showed a strong positive relationship between the loan rate and NPL in Malaysia from the year 2009 to 2018. This study is supported by Messai and Jouini (2013), who also found significant positive results. A panel regression analysis was used on 85 banks in Italy, Greece, and Spain from 2004 to 2008. The study discovered that the positive finding shows that when a bank raises its real interest rate, NPL increase immediately, especially for loans with rates that change over time. This positive connection can also be explained by the fact that borrowers are less likely to be able to keep their commitments. Several other studies, such as those by Ahmed et al. (2021), Badar et al. (2013), Castro (2013), Ciukaj and Kil (2020) Golitsis et al. (2022), and Nargis et al. (2019) have also found a positive correlation between interest rates and NPLs.

Moreover, the research by Kevin and Gyong (2020) also showed a positive and significant result in both the short and long term. However, the long-term relationship between NPL and lending interest rates is insignificant. In this study, the researcher employed the ARDL model to analyze Nigeria's banking sector from 1998 to 2020. In addition, the study conducted by Khouangvichit (2024) found that both in the short and long run, NPLs increase along with the lending rate. On the other hand, the research by Zulkifli and Ahmad (2022a) does not find a significant connection between interest rates and NPLs. The Pooled OLS and Random effects models examined Malaysia's commercial banks over 14 years, from 2007 to 2020. These results are similar to those of Messai and Gallali (2019), Mohamed et al. (2021), and Wairimu and Gitundu (2017), who also found that there was no significant link between interest rates and NPLs.

Furthermore, Sun and Purwanto (2021) found a significant and negative association between these two variables. According to Badruddin and Masih (2018), although there should be a positive association between loan interest rates and NPLs, the findings of their analysis indicate otherwise. This indicates that NPLs keep growing even when interest rates are reduced during financial crises, suggesting an asymmetric relationship. However, these two variables have a symmetric relationship in the long term. Also, this study is supported by research conducted by Saba et al. (2012), who also found negative results in the US banking sector from 1985 to 2010 by employing an OLS model in their analysis. In other words, lower interest rates can lead to increased NPLs. One of the reasons was that decreased rates may encourage riskier borrowing as individuals and businesses capitalize on cheaper credit options, potentially resulting in higher defaults. Other studies conducted by Chang et al. (2008) also shows a negative coefficient between Lending rates and NPLs in the Brazilian Banking systems.

Lastly, according to the study conducted by Sing et. al. (2024) shows that the lending rate analysis shows different results. In this study, the researcher uses the ARDL analysis and the Error Correction Regression Result, which reveals that the ARDL approach indicates that lending rates and NPL are positively significant at the 1% level. According to the study, lower interest rates are associated with a decline in NPLs for both commercial and Islamic banks in terms of residential properties. On the other hand, the Error Correction Regression result shows that the lending rates and NPL are negatively significant. The contrasting relationship between lending rates and NPLs in both the short and long run can be explained by how borrowers react over time. In the

short run, while a loan is just being started, borrowers may still find the interest reasonable, as the full impact of increased lending rates has not yet been seen. This can lead to fewer initial defaults. However, borrowing costs build over time, particularly for significant expenditures such as non-residential properties, which demand a longer payback period. If the money generated by these projects does not keep up with the rising interest rate, borrowers may suffer financial difficulties, increasing the risk of default. This helps to explain why some research shows an adverse effect in the short-term but a positive one in the long run. Therefore, below is the summary of the previous study that analyzes the relationship between Lending Interest rate and NPLs:

Table 2.4
Summary of Empirical Works and Directional Impact of Lending Interest Rate

Independent Variable	Directional Impact	Previous Studies
Lending Interest Rate	Positive Correlation (+)	Ahmed et al. (2021), Badar et al. (2013), Castro (2013), Ciukaj and Kil (2020), Gashi et al. (2022), Golitsis et al. (2022), Kevin and Gyong (2020), Khouangvichit (2024), Messai and Jouini (2013), Nargis et al. (2019), Sing et al. (2024), Vaicondam et al. (2019), and Zainol et al. (2018).
Lending Interest Rate	Negative Correlation (-)	Chang et al. (2008), Saba et al. (2012), Sing et al. (2024), and Sun and Purwanto (2021).
Lending Interest Rate	Not Significant	Kevin and Gyong (2020), Messai and Gallali (2019), Mohamed et al. (2021), Wairimu and Gitundu (2017), and Zulkifli and Ahmad 2022a).

2.3.2.5 NPL and Exchange Rate

Exchange rates are the price of one country's currency that can be exchanged for another. According to Vogler et al. (2019), it is often expressed as the amount of one currency needed to purchase a unit of another currency. Central banks, such as BNM, may play a role in influencing or setting exchange rates as part of their monetary policy to achieve economic goals. Also, Exchange rates are crucial in international trade, investment, and financial transactions. Nevertheless, the exchange rate is classified as a very limited study due to a few factors, including most studies on exchange rates and NPLs tend to focus on short-term periods, particularly during times of economic crises or sudden shocks, such as the GFC or the Covid-19 pandemic. Other than that, especially when borrowers' incomes are in the local currency and their obligations are in a foreign currency, exchange rate fluctuations can have a delayed or prolonged impact on loan repayment.

Several researchers, including Badar et al. (2013), Marouf and Guellil (2017), Skarica's (2014), and Wairimu and Gitundu (2017), have explored the relationship between exchange rates and NPLs and consistently reported insignificant effects of exchange rates. The results of the study conducted by Skarica's (2013), which employed OLS and Fixed Effect analysis with balanced data, yielded insignificant findings. However, Skarica argued that the theoretical expectation of a negative relationship between exchange rates and NPLs remains valid despite the lack of statistical significance. Studies by Klein (2013), Mensah and Adjei (2015), and Radivojevic and Jovovic (2017) all showed a strong and negative link between exchange rates and NPLs, which supports this theoretical idea. Radivojevic and Jovovic (2017) found a correlation between falling local currencies and higher NPL rates. Also, Mensah and Adjei's (2015) study showed that when many loans are made in foreign currency without proper protection, the drop in exchange rates puts borrowers at greater risk, which could cause more NPLs. People who borrow money in foreign currencies may find it harder to pay it back when the local currency falls in value. This is especially relevant if their income is in the local currency. When there is a drop in value, their foreign currency debt costs more in their currency, which causes them to have financial issues. As a result, borrowers may need help to repay their loans, which could cause NPLs to rise.

Besides that, Zain et al. (2020) found a strong positive link between NPLs and exchange rates in Malaysian conventional banks. The study discovered that as the exchange rate increases, NPLs also rise, and conversely, a decrease in the exchange rate corresponds to a decline in NPLs. Also, this study covered the period from 2009 to 2018 and involved eight local commercial banks. It utilized Panel Data Analysis with Random Effects using STATA 14. Ahmed et al. (2021) supported the findings of this study and identified a positive and significant relationship with NPLs. Their study focused on the period from 2008 to 2018 and employed a balanced panel dataset comprising 20 banks from the private and government sectors. The study employed a panel GMM estimator for its analysis. Also, using the ARDL method, the study conducted by Sing et al. (2024), also found that the NPLs and the Exchange rate are positively significant.

Moreover, Kepli et al. (2021) showed a significant and positive relationship between exchange rates and NPL only in the long-run analysis. However, it showed an insignificant sign in the short run. This study utilizes the ARDL model and concentrates on analysing annual data from Malaysia's banking system over three decades, covering the period from 1988 to 2018. As a result, this study discovered a positive correlation between exchange rates and NPLs. It found that a rise in the nominal exchange rate leads to a depreciation of the Malaysian Ringgit (MYR), which may cause inflation and greater NPLs.

Furthermore, Anita et al. (2020) found no significant results in 8 SAARC countries, which are Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan, and Sri Lanka, after collecting yearly data over 12 years (2008-2019). Also, the researcher selected this era to accurately represent the impact of macroeconomic conditions on the bank's loan portfolio, including patterns from the 2007-2008 financial crisis and its aftermath. According to research conducted by Sirpal (2009), on payment methods and foreign exchange risk management among Brunei companies, these indicators should indicate a positive direction. The researcher stated that there is a positive association between currency rates and NPLs, which means that as exchange rates rise, so does the number of NPLs, and vice versa. This is because when the home country's currency weakens, increasing the exchange rate means it takes more local currency to buy foreign currencies. As a result, the cost of imported goods rises. When this happens, local products become cheaper, boosting exports but making imports more expensive. This challenges local customer retention as the prices of locally sold

products increase. Also, according to Sirpal (2009) as the local currency depreciates, it strains the financial system. The increased costs of imported inputs can stress the financial letter of credit issued by banks to traders, elevating the risk of defaults. Also, in line with Pratap and Urrutia's (2004) perspective, significant local currency depreciation deteriorates a firm's net worth, primarily via the balance sheet effect.

Lastly, Chaibi and Ftiti (2015) analysed 147 French and 133 German banks from 2005 to 2011. According to this study, the currency rate is a significant positive driver of NPLs in France but negatively impacts Germany in which the appreciation of local currency affects more expensive local products and directly decreases the competitiveness of export-oriented businesses. Hence, in France the currency rate significantly and positively influences NPLs. In contrast, in Germany, a higher currency rate helps minimize NPLs. Appreciation of the currency rate in Germany enhances the borrower's ability to fulfil their foreign currency obligations, resulting in a decline in the NPL ratio. This conclusion is consistent with Castro's (2013) study findings, which show that increasing this variable leads to increased credit risk. Therefore, below is the summary of the previous study that analyses the relationship between the Exchange Rate and NPLs:

Table 2.5

Summary of Empirical works and directional impact of Exchange Rate

Independent Variable	Directional Impact	Previous Studies
Exchange Rate	Positive Correlation (+)	Ahmed et al. (2021), Castro (2013), Chaibi and Ftiti (2015), Kepli et al. (2021), Sing et al. (2024), and Zain et al. (2020).
Exchange Rate	Negative Correlation (-)	Chaibi and Ftiti (2015), Klein (2013), Mensah and Adjei (2015), and Radivojevic and Jovovic (2017).
Exchange Rate	Not Significant	Anita et al. (2022), Badar et al. (2013), Kepli et al. (2021), Marouf and Guellil (2017), Skarica (2014), and Wairimu and Gitundu (2017).

2.3.3 Unexpected Crises

The selection of crises in this study which are the 2007–2008 GFC, and the COVID-19 pandemic is based on their significant and lasting impact on Malaysia's economy and banking sector between 2002 and 2023. Also, these crises were chosen because of their massive economic shocks, which influenced critical macroeconomic indicators related to NPLs. The GFC led to a decline in economic activity, less trade, and fewer investments, reducing borrowers' repayment capabilities (IMF, 2010). On the other hand, the COVID-19 Pandemic led to one of the most severe economic disruptions in recent history, with prolonged lockdowns, company closures, increasing unemployment, rising credit risks, and loan defaults (World Bank, 2021). These crises indicate severe external shocks that influenced Malaysia's financial stability, making them crucial for understanding NPL patterns and giving lessons for future crisis management measures.

Besides that, the unexpected crises are when a country faces significant crises, including the GFC in 2008-2009, and COVID-19 as the recent crisis in 2019. Hence, all these events are impactful events that can cause economic chaos and disrupt the country's development (Basit & Sulaiman, 2017; Lee and Rosenkranz, 2020; Zulkifli & Ahmad, 2022a). Also, over the past century, the banks faced a dramatic increase in the number of NPLs as the debts kept increasing during the economic downturn (Ozili, 2019; Zulkifli & Ahmad, 2022a).

Furthermore, the number of studies that have investigated the impact of unexpected crises, such as the GFC and the COVID-19 pandemic, on NPLs is relatively limited. The reason is the limitation of time-period coverage, particularly in the context of the COVID-19 pandemic, as the long-term effects on loan performance may not be apparent for several years. Furthermore, the rise of NPLs may have been temporarily suppressed by government interventions, including loan moratoriums and financial assistance programs, which has worsened the complexity of empirical analysis. This may account for the fact that empirical models have received less attention in previous studies when it comes to incorporating crisis periods.

2.3.3.1 *NPL and Global Financial Crises*

The GFC of 2007–2008 had a profound impact on global financial stability, leading to a sharp rise in NPLs across banking sectors worldwide. The crisis triggered by the collapse of the subprime mortgage market in the United States, led to widespread liquidity shortages and economic contractions. Studies such as Castro (2013), and Zulkifli and Ahmad (2022a) have found a positive relationship between the GFC and rising NPLs, primarily due to economic downturns, declining borrower income, and reduced loan repayment capacity.

Besides that, the study conducted by Castro (2013) analysed the macroeconomic drivers of credit risk in banking systems covering Greece, Ireland, Portugal, Spain, and Italy (GIPSI) during the financial crisis. The study concluded that growing unemployment rates, real exchange rate appreciation, and decreased GDP growth largely contributed to the rise in NPLs. The report underlined that the recent financial crisis has led to a large increase in banks' NPLs in numerous nations emphasising how economic contractions during crises boost credit risk.

Lastly, in Malaysia, the studies conducted by Zulkifli and Ahmad (2022a) showed positive and significant results in their finding where the author used panel data from 26 commercial Banks from the year 2007 to 2020 which included the years of the GFC. Thus, below is the summary of previous studies that analyze the relationship between GFC and NPLs:

Table 2.6

Summary of Empirical works and directional impact of GFC

Independent Variable	Directional Impact	Previous Studies
Global Financial Crises	Positive Correlation (+)	Castro (2013), and Zulkifli and Ahmad (2022a).

2.3.3.2 *NPL and Covid-19 Pandemic*

The COVID-19 pandemic, a rare global health crisis, had significant effects on economic stability and financial markets, raising significant concerns about its potential impact on NPLs. Lockdowns across the country, company closures, and rising unemployment have all impacted individuals' and businesses' capacity to repay. Government measures such as loan moratoriums and financial trigger packages

temporarily shielded the banking industry from a substantial increase in NPLs. However, these remedies were time-bound and did not cover all borrowers. Hence, as the support ended, many borrowers, particularly those in vulnerable industries like tourism, hospitality, food and beverage, retail, entertainment, and construction, endured extensive delays, rendering them more prone to financial hardship and increased default risks after the assistance measures were discontinued. In addition, although banks did play a role, the support was not always sufficient or equally distributed, especially for SMEs in vulnerable industries, as stated.

Besides, Zulkifli and Ahmad (2022a) explored the causes of NPLs during unexpected crises in Malaysia, such as the COVID-19 pandemic. Their research discovered that unexpected crises are one of the most important variables influencing NPLs in the banking sector, emphasizing that economic shocks from crises affect borrowers' capacity to repay loans. The study also found that the intensity of the crisis erodes banks' trust in publicly servicing loans as previously, banks become more cautious when lending during crises. Thus, below is the summary of previous studies that analyze the relationship between the COVID-19 Pandemic Crisis and NPLs:

Table 2.7

Summary of Empirical works and directional impact of COVID-19 Pandemic

Independent Variable	Directional Impact	Previous Studies
Covid-19 Pandemic	Positive Correlation (+)	Zulkifli and Ahmad (2022a)

2.4 Literature Gaps in the Study

In this research, a literature matrix, also known as a literature review matrix or synthesis matrix, serves as a systematic approach for organizing and synthesizing material from multiple sources. For example, this study employs a Literature Review Matrix to analyse previous research, identify research gaps, and establish the significance of this topic. The literature is predominantly classified according to similar dependent variables and is selected manually from online articles, as illustrated in Table 2.8. The article/publication screening process is contingent upon various criteria, including the most recent publication date and publications pertinent to the financial crisis period. Also, when selecting journals, the researcher considers the degree of similarity to the independent variables of this study.

Besides that, although the focus is given to recent publications, this study also covers previous work to provide a thorough knowledge of the evolution of research on NPLs. Older studies are not discarded owing to their publication year. Instead, they are purposefully picked based on their fundamental significance, relevance to the Malaysian banking industry, and their continuous impact on more current research. These prior publications serve as significant benchmarks for analysing how macroeconomic factors on NPLs such as inflation, unemployment, GDPG, lending rate, and Exchange rate have developed throughout different economic situations and crisis times. Also, by incorporating both older and current studies, this research has a greater opportunity to investigate how the influence of macroeconomic factors on NPLs has altered over time. This involves assessing whether relationships have stayed stable or changed, caused by fundamental economic changes, initiatives in policy, or global crises. This balanced selection strategy guarantees that the literature evaluation stays both current and contextually rich, giving greater insight into long-term patterns and enabling a more informed appraisal of research gaps and objectives.

Other than that, Table 2.8 primarily shows present developments and trends in the literature concerning examining macroeconomic determinants influencing NPLs in Malaysia as well as the unexpected crises. Through the methodical arrangement and integration of data from diverse sources, this table offers significant perspectives on the current status of research in the respective field. Besides, it is possible to determine the trajectory of future inquiries and assess the progression of research trends over time using the information in the table. Thus, by employing this systematic framework, the literature review matrix enhances the overall comprehension of the subject matter and enables well-informed choices regarding the research design and methodology. Also, this literature review matrix can assist the researcher in recognizing and addressing gaps in the current body of literature.

Next, the literature matrix shows that the study of macroeconomic determinants' impact on NPLs has long been a topic of interest among researchers. However, a critical review of previous literature reveals a notable gap, which is a lack of studies focusing on and addressing the current financial crisis within Malaysia's banking sector. This gap may be attributed to the novelty of the ongoing pandemic and the recent occurrence of the crisis. For example, recent studies that include the pandemic's year data are the study conducted by Zulkifli and Ahmad (2022a), which stated that the Pandemic worsens the

NPLs in banks. Also, Golitsis et al. (2022) conducted a study focusing on a timeframe covering multiple crises, including the Global Financial Crisis of 2007–2009, the European Sovereign Debt Crisis of 2010–2012, the Covid-19 pandemic era, and the Russian Invasion of Ukraine. However, their research focused on North Macedonia, spanning from the first quarter of 2005 to the second quarter of 2022. Therefore, although Malaysia experienced several economic crises, including the commodity crisis in 1985 – 1986, the financial and currency crisis in 1997 – 1998, and the global financial crisis in 2008– 2009, few studies focused on the current pandemic years or even conducted a timeframe considering a trend of crisis. Aside from that, this statement is also supported by the research conducted by Kozarić and Delihodić (2020). In their study, the authors stated that there is still a lack of literature that concentrates on and includes the current financial crisis and problems in the banking sectors worldwide, which calls for more in-depth analysis and comprehension. As a result, in this study, the researcher included the pandemic years and the years of financial crises, such as the GFC of 2008. In other words, this study timeframe is one of the few studies that had the longest timeframe in Malaysia, which, from 2002 to 2023, totalled 21 years in total and also focused on 17 conventional banks (Foreign and Local) in Malaysia.

Moreover, the literature matrix also shows that most research has focused on Western countries. For example, the studies conducted in Western countries are the study by Ahmed et al. (2021), Badar et al. (2013), Chaibi and Ftiti (2015), Chang et al. (2008), Ciukaj and Kil (2020), Gashi et al. (2022), Koju et al. (2018), Makri et al. (2014), Mazreku et al. (2018), Messai and Gallali (2019), Naili and Lahrichi (2022), Saba et al. (2012), and Singh et al. (2021). Thus, only a few studies focus on the macroeconomic influence on NPLs in Malaysia, which has caused unresolved issues that have led to ongoing discussions in Malaysia concerning the relationship between NPLs and macroeconomic factors. For example, a study by Mohamed et al. (2021) stated that the findings of macroeconomic variables such as the inflation rate had a significant positive effect on NPLs at a 5% significance level. Meanwhile, the study by Mahyoub and Said (2021) stated that inflation has no significant impact on the NPLs in the Malaysian banking system.

Lastly, this study also identifies that a thorough analysis of the macroeconomic variables with NPLs in Malaysia is still needed. For example, the exchange and lending interest rates require more attention, whereas unemployment, inflation, and GDPG have

been extensively studied, yielding varied results regarding their relationship with NPLs. For example, studies by Mohamed et al. (2021), Naili and Lahrichi (2022), and Singh et al. (2021) show significant and positive correlations between these variables. In contrast, Anita et al. (2022) found a significant and negative relationship in their analysis. Meanwhile, some studies were not significant, such as those conducted by Huan et al. (2020) and Zain et al. (2020). In addition, as for the exchange rate, only a few significant studies were conducted in Malaysia. For example, Kepli et al. (2021) showed no significant impact of the exchange rate on the NPLs. Thus, as a result, this study will include the exchange rate to analyze, focusing only on Malaysia. Also, as for the lending interest rate, increased loan rates can have a severe influence on borrowers' repayment capacities, resulting in higher defaults. In addition, the greater effects of variable lending interest rates on the amount and quality of loans in Malaysia's banking sector are not commonly understood. Given the volatility in global and domestic interest rates, which have a direct impact on the cost of debt payment, it is necessary to explore this variable to deepen the NPL analysis.

Table 2.8
Literature Review Matrix

Author(s)	Data Sample	Scope of Coverage	Theory	Methodology	Result & Analysis	Limitations
Chang, Guerra, Lima and Tabak (2008)	The semi-annual data of Brazilian banks covers the period from 2000 to 2005.	- Macroeconomic Variables: 1) GDP 2) Inflation Rate 3) Short Term Interest Rate - Systemic Risk: 1) Country Risk 2) Exchange Rate - Banking Concentration (Market Share) - Brazilian Banking Sector	Duality Theory	Quantitative Methods (Dynamic Specifications With Fixed Effects -Panel Data Approach/ Unbalanced Data)	Concentration (Market Value) significantly influences NPLs, whereas systemic risk factors such as country risk and exchange rates do not show a significant impact on NPLs. Among macroeconomic variables, GDP is positively related to NPLs, while inflation and interest rates exhibit a negative relationship with NPLs.	Not Applicable
Saba, Kouser and Azeem (2012)	Data for the US Banking Sector from 1985 to 2010 was collected annually. This timeline was selected because NPL rate data is only available from 1985 onwards.	- Bank Specific Variable (Total Loan) - Macroeconomic Variables: 1) Real GDP Per Capita 2) Interest Rate - Aggregate data for the whole Banking	Optimal Control Theory	Quantitative Methods (Time Series with the Descriptive Statistics, Pearson's correlation and OLS Regression)	Real GDP had a significant negative connection of 68% with the NPL rate, while interest rates had a significant negative correlation of 40.7% with NPLs. In contrast, the bank-specific variable (total loans) shows a significant positive connection with NPLs (28.1%).	The limitations of this study arise from its dependence on a small number of variables. Future studies should include a larger set of Variables. This would help to get a greater understanding of the issue.

System						
Badar and Javid (2013)	This study analyses quarterly data from 36 Pakistani commercial banks from January 2002 to December 2011, aiming to understand the relationship between NPLs and macroeconomic variables during two contrasting periods: economic expansion (2002-2006) and turmoil (2007-2011).	- Macroeconomic Variables: 1) Inflation Rate 2) Interest Rate 3) GDP 4) Exchange Rate 5) Money supply - Commercial Banks	Not Applicable	Quantitative Method with focus on short and long run relationship (EViews Time Series Analysis): 1) Multivariate Cointegration Analysis (Trace Statistics and Maximum Eigen value) 2) Bivariate Cointegration Test 3) Granger Causality Test 4) Vector Error Correction Model	The Bivariate and Multivariate cointegration tests found no clear association between NPLs and Pakistan's currency rates, inflation rates, or GDP. However, the data show a robust and statistically significant positive relationship between NPLs, money supply, and interest rates in the long run. According to the Vector Error Correction Models (VECM), the short-term correlations between NPLs, inflation rates, and currency rates are weak and statistically insignificant.	The study focused on long-term relationships between NPLs and economic factors, with limited exploration of short-term dynamics. Future research should investigate short and long-term dynamics to understand NPL responses to economic changes comprehensively. Besides, the study should address other NPL contributors, such as management issues, regulatory weaknesses, and other external factors, and provide specific policy recommendations for managing NPLs.
Castro (2013)	This research focuses on Greece, Ireland, Portugal, Spain, and Italy, all of which are facing economic issues following	- Macroeconomic Variables: 1) GDP Growth 2) Unemployment Rate	Business Cycle Theory	Quantitative Method (Dynamic and Static Panel Data Approach):	During economic downturns, credit risk increases when GDP and share prices decline (Negative Coefficient) while unemployment, interest rates, and credit	The limitations of this study include its narrow geographic focus on European countries and the limited availability of data, spanning only 15 years on a quarterly basis. Moreover, the study solely

	the financial crisis. The study covers the period from 1997 Q1 to 2011 Q3, corresponding with the establishment of the Euro. Also, these countries were chosen based on data availability, namely NPL data given by their central banks.	3) Interest Rate 4) Credit Growth 5) Shares Price 6) Exchange Rate 7) Inflation Rate 8) Dummy Variable (Financial Crisis Period).		1) Static Panel-Pooled OLS, Fixed and Random Effects. 2) Dynamic Panel - Arellano-Bond (AB) Estimator with Generalized Method of the moments (GMM).	growth rise, resulting in a significant positive correlation with NPLs. Also, real exchange rate appreciation has a positive effect on credit risk, while credit risk increased significantly during the current financial crisis. Finally, the inflation rate has no impact on NPLs.	examines macroeconomic factors, neglecting bank-specific factors. To improve the comprehensiveness of the research, it would be beneficial to incorporate bank-specific factors alongside macroeconomic variables. This holistic approach would facilitate a deeper understanding of banking credit risk and its diverse determinants.
Klein (2013)	This research includes data from 160 banks operating in Central, Eastern, and South-Eastern Europe from 1998 to 2011. The choice of this time period is dependent on data availability.	- Bank-Specific Variables: 1) Equity to asset ratio 2) Return on equity 3) Loan to asset ratio 4) Loan Growth - Macroeconomic Variables: 1) Unemployment	Moral Hazard Theory	Quantitative Method (Dynamic-Panel Vector Autoregression):	This study's findings indicate that numerous economic and bank-specific factors impact NPLs. Specifically, when unemployment rises, the currency rate falls, and inflation rises, NPLs are likely to increase significantly. Meanwhile, a one-percentage-point rise in real GDP leads to a 0.8-percentage-point decrease in NPLs, suggesting a	NPL categorization can vary due to differences in accounting practices and regulatory standards across countries. In this study, we utilize Bank scope data, which reports 'impaired loans.' This classification may not precisely match the official NPL definition. However, for the sake of consistency in the analysis, the researcher treats 'impaired loans' as NPLs.

		- Rate 2) Inflation Rate 3) Exchange Rate 4) GDP - Ten Largest Banks (Commercial, Savings, Cooperate, Real estate and Mortgage).			negative link between economic growth and NPL. Also, bank-specific variables such as a high loan-to-assets ratio and a rapid growth of bank loans lead to greater NPLs. In contrast, Low equity-to-asset ratios and returns to equity are associated with a small number of NPLs, implying a negative association between these variables and NPLs.	
Messai and Jouini (2013)	A total of eighty-five banks from Italy, Greece, and Spain operated between 2004 and 2008. The selection of these countries provides a representative sample of countries that have experienced the effects of both the subprime mortgage crisis and the debt crisis.	- Bank-Specific Variables: 1) Return on assets 2) Change in loans 3) Loan loss reserve to total loans - Macroeconomic Variables: 1) GDP Growth 2) Unemployment Rate 3) Real interest Rate - Conventional Banks	The Business Cycle Theory	Quantitative Method (Static-Fixed Effect Panel Regression)	An increase in GDP significantly reduces NPLs. Meanwhile, rising unemployment rates, interest rates, and larger Loan Loss Provisions significantly raise NPLs. On the other hand, banks with higher profitability, indicated by a higher return on assets (ROA), significantly have fewer NPLs. Lastly, changes in loan volume do not substantially affect the NPL levels.	This study could benefit from including other macroeconomic factors, such as the real exchange rate, inflation rate, and bank-specific variables like size and liquidity. Also, it focuses on a single type of loan. Future studies should look at classifying non-performing loans by type to offer a more complete insight.

Makri, Tsagkanos and Bellas (2014)	The researcher collected data from 14 Eurozone countries covering the years 2000 to 2008, with a particular focus on the period preceding the recession, commonly referred to as the pre-crisis era.	- Bank-Specific Variables: 1) Bank Capital and Reserves to total assets 2) Loans to deposit Ratio 3) Return on assets 4) Return on equity - Macroeconomic Variables: 1) GDP growth 2) Public Debt 3) Unemployment Rate 4) Inflation Rate 5) Government Budget - Aggregate data for the whole Banking system of each country.	Moral Hazard Theory	Quantitative Method (Dynamic Panel Regression-Difference GMM)	This study identifies strong correlations between NPLs and key variables. Bank-specific factors such as ROE and CAR exhibit significant negative associations, while macroeconomic indicators such as Public Debt and Unemployment demonstrate strong positive relationships with NPLs. In addition, the GDP growth rate is negatively correlated and significant with NPL. However, variables like ROA, LTD, Fiscal Policy, and the inflation rate show no significant impact on NPLs.	This study is constrained to the years 2000 to 2008 due to data availability limitations across all Eurozone countries. Future research could broaden the scope by incorporating more recent data. Besides, while this study focused solely on Eurozone countries, expanding the analysis to include the EU27 could provide a more comprehensive understanding.
Skarica (2014)	This dataset includes quarterly observations for seven Central and Eastern European (CEE) countries between Q3 2007 and Q3 2012. Due	- Macroeconomic Variables: 1) Real GDP Growth 2) Unemployment Rate 3) Exchange Rate	Not Applicable	Quantitative Method (Ordinary Least Squares and Fixed Effect analysis -Balance Panel Datasets)	The study's findings show that all factors are significant except for the share price index and exchange rate. Notably, unemployment and inflation rates have a positive and significant	One constraint of this study is the limited availability of data on NPLs. In order to address this issue, future studies should include a longer period for NPLs in every country. This method would improve policymakers' comprehension,

	to data availability constraints, the chosen period and countries included are Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Romania, and Slovakia.	4) Inflation Rate 5) Share Price Index - Aggregate data for the whole Banking system of each country.			impact on NPLs in Central and Eastern European nations. Meanwhile, GDP growth has a significant negative influence. It shows a clear negative association between GDP growth and NPL, with a 1 percentage point increase in GDP growth rate resulting in a 3.97 percentage point drop in NPL growth rate.	offering a more detailed direction for stabilizing the financial system in the aftermath of the crisis.
Chaibi and Ftit (2015)	It included a total of 147 French banks and 133 German banks during the years 2005 and 2011. The author does not specifically clarify the rationale behind selecting this specific time. However, it aligns with notable financial crises such as the global financial crisis and the European debt crisis. The time frame also pertains to the availability of data, which could lead to an	- Bank-Specific Variables: 1) Inefficiency 2) Leverage 3) Size 4) ROE - Macroeconomic Variables: 1) Inflation rate 2) GDP Growth 3) Unemployment rate 4) Exchange rate - Conventional Banks	Phillips' Curve Economic Theory, Moral Hazard Theory and Too big to fail Theory	Quantitative Method (Dynamic Panel Regression (Difference & System GMM)-Unbalance Data)	This study examines credit risk indicators in market-based (French) and bank-based (German) economies. In France, macroeconomic factors such as GDP growth (negative) and unemployment (positive) significantly impact NPLs, while the inflation rate shows no correlation. Besides, the real appreciation of this variable increased the NPLs. In contrast, in Germany, macroeconomic factors like inflation and GDP growth negatively influence credit risk, while the unemployment rate positively impacts NPLs. Furthermore, there is a negative association	This study focuses solely on French and German banks. As a result, doing research in different nations might be beneficial.

	unbalanced dataset.				between NPLs and exchange rates in Germany.	
Mensah and Adjei (2015)	This study is distinctive in the Ghanaian literature because it analyzes data from 1998 to 2008 and includes a mix of 12 banks, featuring both large and small ones.	- Bank-Specific Variables: 1) Bank Size 2) Previous Year NPLs 3) Net Interest Margin 4) Loan Growth - Macroeconomic Variables: 1) Inflation Rate 2) GDP Growth 3) Exchange Rate - Conventional Banks (Large and small Banks included)	Not Applicable	Quantitative Method (Panel Data Regression Analysis)	These findings indicate that all bank-specific variables were found to be relevant. Specifically, the previous year's NPLs and the size of the bank had a significant and positive influence on the NPLs. In contrast, NPLs are negatively and significantly impacted by both net interest margin and loan growth. Meanwhile, All macroeconomic variables have a significant and negative influence on the NPLs in Ghana's banking sector.	Not Applicable
Koju, Koju and Wang (2018)	This study investigates 30 Nepalese commercial banks from 2003 to 2015, with variable selection and the chosen timeframe based on a thorough review of existing	- Bank-Specific Variables: 1) Credit/Loan to Deposit Ratio 2) The loan to asset Ratio 3) Return to asset 4) Interest Spread 5) Capital Adequacy Ratio	Too big to fail Theory, Bad Management Theory and Moral Hazard Theory	Quantitative Method (Unbalance Panel-Static and Dynamic Panel Regression)	This study concluded that Bank Specific variables such as Bank Size, Return on Assets, and Loan to Assets are insignificant. On the other hand, Capital Adequacy and Credit Deposit Ratios negatively and significantly affect NPLs. However, operating expenses and interest	While the present study offers valuable insights, it also carries certain limitations. The exclusion of development banks and the relatively short study duration may have implications for the comprehensiveness of the findings. Furthermore, the narrow focus on a specific set of countries might restrict the

	literature and data availability. The analysis covers 13 years, including economic growth and the subsequent global financial crisis.	6) Operating Expenses to Operating income Ratio 7) Bank Size • Macroeconomic Variables: 1) GDP Growth Rate 2) Remittance Rate 3) Export to import Ratio 4) Public Debt 5) Inflation Rate • Commercial Banks			spread positively affect NPLs. As for the Macroeconomic variables like public debt and export-to-import ratio, they positively and significantly affect NPLs. At the same time, GDP growth and inflation have a negative and significant impact on the NPLs. Lastly, Remittance is the only insignificant variable.	generalizability of the results. To achieve a more comprehensive understanding, future research endeavours should contemplate the inclusion of development banks, prolonging the study duration, and exploring a wider spectrum of underdeveloped and least-developed countries. Additionally, a more intricate examination of regulatory, institutional, and legal factors could further enrich our comprehension of the determinants of NPLs.
Radivojevic and Jovic (2017)	The dataset includes data from 25 emerging countries (such as Albania, Algeria, Bulgaria) spanning 2000 to 2011, and it has an unbalanced panel structure (NPLs). The main emphasis is on the periods before and during the financial crisis. Regrettably, the authors excluded	• Bank-Specific Variables: 1) Return on assets 2) Capital to assets ratio 3) Loan loss provision 4) Net interest margin ratio • Macroeconomic Variables: 1) GDP	Not Applicable	Quantitative Method (Unbalance Panel-Static and Dynamic Panel Regression): GMM)	GDP, inflation, and the unemployment rate all have a positive influence on NPLs, but the House Price Index and exchange rates have a negative effect. The authors suggest these macroeconomic factors have a significant impact on NPLs. Meanwhile, bank-specific indicators such as CAR, LLP, and NIMR have a positive correlation with NPLs. Furthermore, there is a negative correlation between NPLs and ROA.	Not Applicable

	the years post-crisis (2011-2014) due to insufficient data.	2) Unemployment Rate 3) Inflation Rate 4) Exchange Rate 5) House Price Index				
		Aggregate data for the whole Banking system				
Marouf and Guellil (2017)	The authors specifically examine the Algerian Banking System from 1980 to 2014, a timeframe chosen to align with the researcher's objectives. This period aims to uncover the factors influencing the accumulation of NPLs at a macroeconomic level within the Algerian banking systems.	- Macroeconomic variables: 1) Unemployment Rate 2) Credit 3) Financial Development 4) GDP 5) Investment 6) Money supply 7) Political Stability 8) Exchange rate	Not Applicable	Quantitative Method (E-views 9-OLS): 1) Unit Root Test (ADF) 2) Cointegration Test (Johansen Test) 3) VECM 4) Granger Causality Test 5) Method of Ordinary Least Squares	This study reveals distinct associations between NPLs and key economic indicators within the Algerian banking systems. Positive correlations are identified with financial development, money supply, and political stability, while a negative impact is observed on GDP. However, variables such as unemployment, credit, investment, and the real exchange rate do not affect NPLs in Algeria's banking sector.	The study suggests that including more varied examples would be helpful. Right now, the examples used might cover only some of the different types of banking systems, which could make it harder to apply the findings widely. Also, the study suggests looking at NPLs based on the sector of activity to get a better understanding. But, there's a problem in obtaining and analyzing data specific to each sector, as it can vary a lot between industries.

Wairimu and Gitundu (2017)	This study focuses on Kenya's banking system between 1998 to 2015. The Researchers likely chose this specific timeframe to assess critical events, regulatory adjustments, and economic factors influencing the sector during this period.	- Macroeconomic Variables: 1) GDP growth rate 2) Inflation rate 3) Interest rate 4) Exchange rate 5) Remittances 6) Unemployment rate 7) Public Debt - Aggregate data for the whole Banking system	The Life Cycle Theory, The Deflation Theory and The Financial Accelerator Theory	Quantitative Method (Linear Regression Model)	According to the results of this study, only unemployment and remittances are significant. Specifically, the relationship between unemployment and remittances shows a positive relationship with NPLs.	They focus solely on macroeconomic variables. As a result, for future studies, researchers should investigate and include more explanatory factors, such as bank size, management, loan level, net interest margin, loan-to-assets ratio, capital adequacy ratio, and return on equity. Aside from that, one of this study's limitations is the need for more statistically significant connections between variables, which may limit the extent to which meaningful relationships and conclusions can be drawn from the data. GDP, inflation, the exchange rate, public debt, and interest rates are all insignificant.
Mazreku, Morina, Misiri, Spiteri and Grima (2018)	This research looks at countries in transition in Southeastern Europe, including Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Kosovo, Macedonia, and Romania, from 2006 to 2016. This period was	- Macroeconomics variables: 1) GDP Growth 2) Inflation Rate 3) Unemployment Rate 4) Export - Aggregate data for the whole Banking system	Not Applicable	Quantitative Method (Applying STATA Software) 1) Pooled OLS 2) Fixed Effects Model 3) Random Effects	This study found a significant negative association between macroeconomic indicators (GDP and inflation rate) and NPLs. In contrast, the unemployment rate has a strong positive relationship with NPLs. However, there were no statistically significant findings on the relationship between export growth and NPLs.	Not Applicable

	selected because it coincides with significant economic and political changes towards market-oriented systems.			Model		
				4) Arrellano-Bond GMM		
Zainol, Nor, Ibrahim and Daud (2018)	The dataset covers 19 years, from the first quarter of 2006 to the fourth quarter of 2015, and includes quarterly data for Malaysia-based analysis.	- Macroeconomic Variables: 1) GDP 2) Inflation Rate 3) Household Income 4) Lending Rate - Aggregate data for the whole Banking system	Not Applicable	Quantitative Method (ARDL Model in EViews-7 for Short-Run and Long-Run Dynamics)	The findings suggest that GDP has a significant negative impact on NPLs, meaning that higher GDP is associated with lower NPLs. On the other hand, both lending rate and household income distribution are significant and positively related to NPLs, as anticipated. However, contrary to expectations, inflation did not show a significant relationship with NPLs in the study.	One limitation of this study is its reliance on a single model. While this model offers valuable insights, employing a variety of models could strengthen the findings by capturing different aspects of the relationship between macroeconomic variables and NPLs. Additionally, the study's scope is confined to a specific set of macroeconomic variables, such as GDP growth and inflation. Incorporating additional macroeconomic factors, such as exchange rates, money supply, unemployment rates, and foreign direct investment, could provide a more comprehensive understanding of the factors influencing NPLs. Moreover, the study focuses solely on Malaysia, limiting the generalizability of the findings to other Asian countries. Expanding the research to include a broader

range of countries in the region would facilitate a more thorough exploration of the topic.

Messai and Gallali (2019)	The study focuses on 18 European countries during the period 2000 to 2011.	- Macroeconomic Variables: 1) GDP 2) Unemployment Rate 3) Stock Price Index 4) Consumption Price Index 5) Real Interest Rate 6) Inflation Rate	Not Applicable	Quantitative Method (Panel Vector Autoregressive)	This study indicates that several variables, including the consumer price index, stock price index, inflation, and the unemployment rate, show statistically significant relationships. The consumption price index, inflation, and unemployment rate have a positive correlation with NPLs. Meanwhile, the stock price index has a significant negative correlation. Finally, the correlation between the real interest rate and GDP is insignificant.	Not Applicable
Mustafa and Ali (2019)	Malaysian Commercial Banks from 1998 to 2018 on a quarterly basis	- Macroeconomics Variables: 1) GDP 2) Inflation Rate 3) Unemployment Rate - Commercial Banks	Not Applicable	Quantitative Method (Utilizing the ARDL Model for Comprehensive analysis of Long and Short-Run Dynamics):	The study found that macroeconomic factors don't immediately impact NPLs, but relationships emerge over the long term. GDP growth is linked to decreased NPLs (negatively correlated), while unemployment is associated with increased NPLs (positively correlated). Interestingly, there is no	Not Applicable

					clear link between inflation and NPLs.	
Nargis, Ahmad, Ibrahim and Kefeli (2019)	This study encompasses a comprehensive analysis spanning 29 years, from 1990 to 2018, focusing on Bangladesh Banks' data. Notably, yearly data is employed in the analytical process.	- Macroeconomic variables: 1) GDP Growth 2) Unemployment Rate 3) Inflation Rate 4) Real Interest Rate 5) One Period Lag Value of NPL - Aggregate data for the whole Banking system	Not Applicable	Quantitative Method (EViews 9-Multiple Regression Analysis)	This study found that the unemployment rate, inflation rate, real interest rate, and one-period lag value of NPL all had significant effects on the NPL rate. According to the results, inflation and unemployment rates in Bangladesh are negatively associated with NPLs. In contrast, the real interest rate and one-period lag value of NPLs are positively related to NPLs in Bangladesh. However, the GDP growth rate is insignificant in relation to Bangladesh's NPL rate.	Study limitations include restricted data availability for both dependent and independent variables over an extended period. Future research can enhance the robustness of findings by incorporating longer data periods and exploring additional relevant independent variables. This approach aims to provide a more comprehensive understanding of potential influences on NPLs in Bangladesh.
Kartikasary, Marsintauli, Serlawati and Laurens (2019)	The data utilized in this research comprises data gathered from 43 banking sector companies listed in Indonesia, covering the years 2014 to 2017.	- Bank-specific variables: 1) Bank Capital and Reserve to Total Assets 2) Loans to deposit Ratio 3) Return on Assets 4) Return on Equity	Not Applicable	Quantitative Method (Panel Data Regression Model with SPSS)	This study uncovers notable relationships: bank-specific factors like CAP, ROA, and ROE show a significant negative association with NPLs, while only LTD exhibits a significant positive relationship with NPLs. Meanwhile, macroeconomic variables, including public debt and GDP, reveal a significant positive link with NPLs. In	The study's limitations lie in its narrow focus on specific internal factors and macroeconomic variables within a defined research period. Future research endeavours could overcome this limitation by exploring a broader range of influences over an extended timeframe.

		• Macroeconomic variables: 1) Public Debt 2) Government Budget Deficit 3) GDP Growth 4) Inflation Rate 5) Unemployment Rate • Banking Companies			contrast, the unemployment rate was found to have a negative coefficient. Lastly, it's important to highlight that the researcher excluded government budget deficits and inflation due to difficulties explaining their relationship with NPLs.	
Vaicondam, Hishan and Shan (2019)	The sampling period will cover 10 years of Malaysian banks from 2009 until 2018. Also, this study is collected annually, and the census is used as the research method to collect the whole nation's population.	• Macroeconomic Variables: 1) Inflation Rate 2) Unemployment Rate 3) Interest Rate • Malaysia Conventional and Islamic Banks.	Information Asymmetric theory, Agency cost theory and credit default theory	Quantitative Method (Simple Linear Regression Model - SPSS):	The analysis found no correlation between NPLs and inflation. However, the unemployment rate showed a positive association, as higher unemployment risk and income uncertainty led to increased NPLs. Additionally, rising interest rates were linked to higher loan repayment costs and NPL growth, indicating a positive relationship between NPLs and interest rates.	The limitation is that the study is solely conducted in Malaysia due to time constraints, limiting the generalization of findings to other countries. Besides, the use of annual data may restrict the accuracy of the analysis. Monthly or quarterly data could provide a better grasp of the trends. Also, the study recommends future research focus more on internal factors such as credit management. Lastly, the study relied on European studies because there is little research on this topic specific to Malaysia. However, the researcher needs to be cautious as economic

situations and banking practices can be different in Europe, and this might introduce biases into the study findings.

Ciukaj and Kil (2020)	The study concentrated on EU member state banks with high NPL levels in 2017, including Bulgaria, Croatia, Cyprus, Italy, Ireland, Greece, and Portugal. The panel data covered 629 banks operating continuously from 2011 to 2017.	- Bank-specific Variables: 1) Size of the bank 2) Cost to income Ratio 3) Share of loans in Total assets 4) Lending Policy 5) Profitability 6) Banks Business Model 7) Total Capital Ratio - Macroeconomic Variables: 1) GDP Growth Rate 2) Inflation Rate 3) Unemployment Rate 4) Interest Rate 5) Investment In Housing 6) House Price	Not Applicable	Quantitative Method (Static Panel Model):	At a significance level of 1%, this analysis suggests that bank size and lending policy are the only microeconomic factors significantly affecting NPLs. Conversely, macroeconomic indicators such as GDP growth rate and housing investment exhibit a negative correlation with NPLs. However, unemployment, interest rates, and home price indexes show a significant positive correlation with NPLs. Additionally, the inflation rate does not appear to have an impact on NPLs.	Not Applicable
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		Indices				
		Commercial, Cooperative and Specialized banks.				
Kevin and Gyong (2020)	This study focuses on Nigerian commercial banks from 1998 to 2020. The selection of this period is influenced by factors such as the collapse of crude oil prices and the impact on domestic debt. Although not explicitly mentioned by the researcher, these events are pivotal in understanding banking dynamics during the chosen timeframe.	- Macroeconomic Variables: 1) GDP 2) Inflation Rate 3) Interest Rate 4) Domestic Debt 5) Unemployment Rate - Commercial Banks	Adverse Selection theory and Moral Hazard theory	Quantitative Method (Time Series-ARDL Model for Comprehensive Analysis of Long and Short-Run Dynamics):	The study provides important insights into both long- and short-run methods. In the long term, the study shows that only domestic debt service has a positive and statistically significant link with NPLs. Other factors, such as GDP, inflation rate, lending rate, and unemployment rate, have positive associations with NPLs but lack statistical significance. In the short term, the findings show that GDP, unemployment rate, and domestic debt service are all strongly and negatively related to NPLs. Meanwhile, the inflation and lending rates have a positive and significant impact on NPLs.	Not Applicable

Koju, Koju and Wang (2020)	Over the period spanning 2000 to 2015, encompassing both pre- and post-global financial crisis years, data was collected annually from 49 high-income countries.	- Macroeconomics Variables 1) Export of goods and services (EOGS) 2) GDP Growth Rate 3) GDP per capita Growth rate 4) GNI per capita Growth rate 5) Industry value To GDP (IVA) 6) Unemployment Rate 7) Gross National expenditure (GNE) 8) Inflation rate - Aggregate data for the whole Banking system	Not Applicable	Quantitative Method (Dynamic Panel Model)	This study emphasizes the influence of economic cycles, driven by indicators such as GDP growth rate (GDPGR), gross national income (GNI) per capita growth rate, and GDP per capita growth rate (GDPPCGR), on credit risk. It suggests that these factors negatively impact credit risk. Additionally, the research highlights that industry value and export activities have a negative effect on NPLs, thereby improving credit quality. This underscores the importance of promoting industrial development and trade openness to mitigate financial crises. Furthermore, the study reveals a significant positive relationship between unemployment, inflation, and NPLs. However, gross national expenditure (GNE) plays a relatively minor role in reducing NPL levels in developed countries.	The study faces potential limitations due to variations in how countries collect and report NPL data, which could affect its reliability. Additionally, focusing solely on a specific time period may overlook recent developments in the economy and changes in banking practices. Therefore, the study's findings may be relevant primarily to the period studied and may not fully reflect current or future circumstances. Furthermore, the applicability of the study's conclusions may vary across countries with different income levels. Therefore, proposed policy recommendations, such as advocating for expansionary fiscal policies, should be carefully considered and adapted based on each country's unique economic conditions. It's crucial to recognize that each country has its own distinct economic situation, and solutions should be tailored accordingly.
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Huan, Ramasamy, Yen and Pillay (2020)	The study focuses on evaluating credit risk in 8 selected Malaysian conventional banks. The analysis's primary source of data is the bank's annual reports, which span 10 consecutive years, from 2008 to 2017.	- Bank-Specific Variables: 1) Bank Size 2) Rate of Return 3) Bank Performance 4) Capital Adequacy 5) Personal Loan - Macroeconomic Variables: 1) Inflation Rate 2) Unemployment Rate - Conventional Banks	Portfolio Theory	Quantitative Method (Ordinary Least Square model) 1) Descriptive Statistics 2) Correlation Analysis 3) Ordinary Least Square 4) Fixed Effect Analysis	In this study, the bank-specific component revealed that bank size, capital adequacy ratio, and personal loan had a negative and significant connection with NPLs. Meanwhile, the rate of return and bank profitability do not correlate with NPL. At the same time, the unemployment rate was the only macroeconomic measure that showed a significant positive relationship with NPLs. In contrast, the inflation rate was shown to have no significant effect on credit risk.	Not Applicable
Zain, Ghazali and Daud (2020)	The study's sample consists of imbalanced panel datasets from eight Malaysian commercial banks. The datasets cover the years 2009 to 2018, and comprise 80 observations.	- Bank-Specific Factors: 1) Bank Size 2) Capitalization 3) Net Interest Margin - Macroeconomic Variables: 1) Real GDP Growth Rate	Not Applicable	Quantitative Method (Unbalance Panel Data Analysis with Random Effects - STATA 14) 1) Descriptive Statistics 2) Correlation 3) Random	The findings of this study indicate that capitalization has a significant negative link with NPLs. In contrast, the real effective exchange rate showed a strong positive association with NPLs. However, bank size, net interest margin, inflation rate, and GDP are all negative and insignificant when it comes to NPLs.	The study has several limitations. Firstly, it focuses exclusively on Malaysia, so it's essential to acknowledge that the findings may not apply universally. Additionally, obtaining data is challenging due to regulatory constraints in the banking sector, leading to occasional incomplete and inconsistent information. Furthermore, the study's timeframe only covers the years 2009 to 2018,

		2) Inflation Rate 3) Real Effective Exchange Rate		Effects Model		potentially overlooking longer-term trends. Moreover, the reliance on annual data due to time constraints may not fully capture the complexity of the subject. Finally, the study exclusively examines conventional banking in Malaysia, neglecting the Islamic banking sector.
		Conventional Banks				
Kozaric and Dzelihodzic (2020)	This study examines Bosnia and Herzegovina's banking sector from 2006 to 2017, encompassing both pre-crisis and crisis periods.	- Macroeconomic Variables: 1) GDP Growth 2) Inflation Rate 3) Unemployment Rate - Aggregate data for the whole Banking system (Bosnia and Herzegovina's)	Not Applicable	Quantitative Method (OLS Model) 1) Descriptive Statistics 2) Correlation Analysis 3) Regression Analysis 4) Ordinary Least Square 5) Fixed Effect Analysis	The findings of this study reveal that both unemployment and inflation have a positive and significant impact on NPLs. Meanwhile, GDP growth exhibits a negative and significant association with NPLs.	Not Applicable

Ahmed, Majeed and Thalassinios and Thalassinios (2021)	This study annually examines Pakistani commercial banks from 2008 to 2018, utilizing a balanced panel dataset of 20 banks from both the private and government sectors.	- Bank-Specific Variables: 1) Credit Growth 2) Loan Loss Provision 3) Bank Diversification 4) Operating Efficiency 5) Bank Size 6) Return on Assets 7) Net Interest Margin 8) Government Ownership 9) Family Ownership - Macroeconomic Variables: 1) Interest Rate 2) Exchange Rate 3) Political Risk 4) GDP Growth - Commercial Banks	Not Applicable	Quantitative Method (Balanced Panel - GMM Estimator) 1) Descriptive Statistics and VIF 2) J Test of Hensen (To evaluate second-order serial correlation, we employ the J test to validate instruments and the Arellano-Bond AR (2) Test). 3) System GMM	The findings of this study show that, among bank-specific factors Credit Growth, Loan Loss Provision, Net Interest Margin, and Government Ownership all have a positive and significant impact on NPLs in Pakistani commercial banks. Meanwhile, operating efficiency and bank size have a negative and significant impact on NPLs. However, Bank Diversification and Return on Assets are not statistically significant. In terms of macroeconomic determinants, all variables show statistical significance and a positive relationship with NPLs, with the exception of GDP growth, which has a negative and significant impact on NPLs.	The study's limitation is that it evaluates the influence of bank-specific and macroeconomic variables on NPLs using secondary data rather than primary data. Besides from that, the limitation is related to data availability, given that only 20 commercial banks were active in Pakistan at the start of 2000. Lastly, future research efforts might broaden the scope of the analysis by including additional bank-specific variables, such as profitability and liquidity size, as well as macroeconomic indicators, such as unemployment and inflation.
Kepli, Bani, Rosland and Laila (2021)	The study focuses on Malaysia's banking system, analysing annual data spanning three decades,	- Macroeconomic Variables: 1) Industrial Production Index 2) Inflation Rate	Financial Accelerator Theory, Asymmetric Information Theory and	Quantitative Method (ARDL Model)	The empirical results are ambiguous. In the long run, the exchange rate is positively and strongly associated with NPLs, but industrial production and	Not Applicable

	from 1988 to 2018.	3) Money Supply 4) Exchange Rate • Aggregate data for the whole Banking system.	Optimal Control Theory		the money supply have negative and significant correlations. However, inflation does not affect NPLs in Malaysia. In the short term, only industrial production and inflation have significant impacts on NPLs. Industrial production is negatively connected to NPLs, implying that increased production tends to reduce NPLs. In contrast, inflation is positively related to NPLs, implying that greater inflation rates lead to larger NPLs. Lastly, In the short run, the money supply and the exchange rate do not affect NPLs.	
Kjosevski and Petkovski (2021)	This study focuses on 21 commercial banks operating in the Baltic States (Estonia, Latvia, and Lithuania) between 2005 and 2016, emphasizing the utilization of yearly data.	• Bank-Specific Variables: 1) Ratio of Equity To Total Assets 2) Return on Assets 3) Return On Equity 4) Growth of Gross Loan • Macroeconomics Variables: 1) GDP Growth	Moral Hazard and Bad Management Theory	Quantitative Method (Panel Data/ Dynamic Panel Model- Difference and System GMM)	In this study, an analysis of macroeconomic variables reveals that public debt, unemployment, and inflation rates positively correlate with NPLs. Conversely, GDP demonstrates a significant negative relationship with NPLs, indicating that a stronger GDP is associated with a decrease in NPLs. Notably, the significance of export growth on NPLs is only evident in the fixed	It is limited by the relatively narrow sample range and the specific duration of the study period. A broader and more extended dataset encompassing a diverse set of countries and a longer time span could further strengthen the generalizability and depth of future research.

		2) Inflation Rate 3) Unemployment Rate 4) Public Debt 5) Export Growth - Commercial Banks			effect model, suggesting its limited role as a determinant of NPLs in commercial banks within the sampled data. Meanwhile, regarding bank-specific factors, all variables exhibit a significant negative impact on NPLs.	
Mahyoub and Said (2021)	The study encompasses the timeframe from 2010 to 2018 and incorporates a comprehensive set of 15 commercial banks in Malaysia, comprising seven domestic banks and eight foreign banks.	- Bank-Specific Variables: 1) Capital Adequacy Ratio 2) Loan to Deposit Ratio 3) Bank Size - Macroeconomics Variables: 1) Real GDP 2) Inflation Rate - Commercial Banks	Moral Hazard Theory	Quantitative Method (Ordinary Least Squares and Balanced Panel Data)	This finding reveals that the Capital adequacy ratio significantly influences the NPLs. Meanwhile, other bank-specific and macroeconomic variables are insignificant and do not impact the NPLs.	The study's dataset is limited to the period between 2010 and 2018, potentially compromising its ability to accurately reflect the current situation. Given the dynamic nature of economic conditions and regulatory frameworks in the banking sector, the factors influencing bad loans may have undergone changes over time. Consequently, the findings of the study may have limited applicability in understanding contemporary or future scenarios.
Mohamed, Hamid, Hosin and Isa (2021)	This study utilizes monthly data from 2015 to 2019 to examine the Malaysian banking system.	- Macroeconomic Variables: 1) Interest Rate 2) Unemployment Rate	Not Applicable	Quantitative Method (Multiple Regression Analysis)	The findings show that unemployment has a significant negative influence on NPLs in Malaysia's banking system, whereas inflation has a	The study's limitation is its narrow focus on only a few variables, which might miss out on important factors affecting the phenomenon. Not including extra variables

		3) Inflation Rate			positive effect. In contrast, the interest rate is deemed insignificant and has a positive correlation with NPLs.	like exchange rates and not analyzing data at different times restrict the depth of understanding.
Petkovski, Kjosevski and Jovanovski (2021)	The study includes data from 18 banks in Poland, utilizing annual data from 2005 to 2018. The author specified that the chosen timeframe predominantly encompasses the crisis and post-crisis periods and the final three years of the pre-crisis boom (2005-2007).	- Bank-Specific variables: 1) Return on Equity 2) Share on Equity 3) Credit Growth - Macroeconomic Variables: 1) GDP Growth 2) Inflation Rate 3) Domestic Credit 4) Unemployment Rate - Fiscal Variables: 1) Public Debt 2) The Government Fiscal Position - Commercial Banks	Not Applicable	Quantitative Method (Unbalanced Panel - The Fixed and random effects model, Difference GGM and system GMM):	In this study for bank-specific factors, only credit growth negatively affects NPLs in three models. The ROE indicates that profitability has a significant and negative impact on NPLs but only on the first model, the fixed effect model. For macroeconomic variables, GDP growth and domestic credit negatively correlated with NPLs. However, public debt and unemployment had a significant and positive relation with NPLs, as the other variables, such as the inflation rate and the government's fiscal position, were insignificant in all models.	The study was limited to a single country. Consequently, future research endeavours should broaden the sample to encompass countries similar to Poland, such as the Czech Republic. Furthermore, there is a need to extend the scope to include various types of loans.
Singh, Basuki and Setiawan (2021)	This study investigates	Bank-Specific Variables:	Not Applicable	Quantitative Method	Based on the study's findings, bank size has a	Not Applicable

	Nepalese commercial banks from 2015 to 2019, with a dataset of 74 observations, offering insights into their performance during this period.	1) Bank Size 2) Capital Adequacy Ratio 3) Return on Assets - Macroeconomic Variables: 1) GDP Growth 2) Inflation Rate - Commercial Banks		(Multiple Regression)	negative and significant impact on NPLs. Meanwhile, the Return on Assets indicates a positive movement. However, the capital adequacy ratio has no significant effect on bank NPLs. Macroeconomic variables such as GDP and inflation have a significant positive influence on bank NPLs.	
Sun and Purwanto (2021)	This study focused on analyzing seven Chinese commercial banks from 2010 to 2019, comprising five state-owned and two national joint-stock banks. A total of 70 observations were selected for data analysis.	- Bank-Specific Variables: 1) Capital Adequacy Ratio 2) Return on Asset - Macroeconomic Variables: 1) GDP Growth 2) Bank Interest Rate 3) Inflation Rate - Commercial Banks	Financial Fragility theory and Bank Behaviour theory	Quantitative Method (Multiple Linear Regression - EViews 10)	These findings show that macroeconomic factors such as Bank Interest rates and inflation rates show a negative and significant relationship with the NPLs. Meanwhile, only the GDP growth rate has an insignificant negative correlation. As for bank-specific factors, both variables show insignificant negative impacts on the NPLs.	The study focused on China's top 10 state-owned banks. Thus, the findings may not apply to non-state-owned banks.
Anita, Tasnova and Nawar (2022)	The study analyzes eight SAARC nations (Afghanistan, Bangladesh,	- Macroeconomics Variables: 1) Money Supply 2) Exchange Rate	Not Applicable	Quantitative method (Ordinary least square model, fixed effect and	The empirical results indicate statistically significant connections at the 0.05 significance level. Specifically, there is a	Not Applicable

	Bhutan, India, Nepal, Maldives, Pakistan, and Sri Lanka) based on yearly data gathered over a comprehensive 12-year timeframe (2008-2019). The researcher selected this specific era to demonstrate the impact of macroeconomic conditions on the bank's loan portfolio, specifically focusing on the period, including the 2007-2008 financial crisis and its aftermath.	3) GDP Growth Rate 4) Government net Lending 5) Inflation Rate 6) Sovereign Debt - Aggregate data for the whole Banking system		random effect estimation)	negative relationship between money supply and GDP with NPLs, whereas FISCAL has a positive correlation with NPLs. At a significance level of 0.10, there is a robust negative relationship between inflation, government debt, and NPLs. However, the average exchange rate exhibits an insignificant positive association with NPLs.	
Gashi, Tafa and Bajrami (2022)	The Western Balkans region during the years 2000 to 2019	- Macroeconomics Variables: 1) GDP 2) Inflation Rate 3) Unemployment Rate 4) Interest Rate - Aggregate data for the whole	Not Applicable	Quantitative method (Panel Data/ STATA -GMM, Fixed effect model and Random effect model)	Findings indicate that macroeconomic factors affect NPLs. Interest rate and GDP annual sales positively correlate with NPL. Government final consumption, inflation, gross domestic saving, and unemployment Negatively impact NPLs.	A limitation of this study is its restricted timeframe due to the inclusion of only 139 observations, which may not fully optimize the application of the panel regression model.

Banking system						
Golitsis, Khudoykulov and Palanov (2022)	The study encompasses the timeframe from Q1 2005 to Q2 2022 in North Macedonia, encompassing notable financial crises such as the Global Financial Crisis (GFC) of 2007–2009, the European Sovereign Debt Crisis of 2010–2012, the Covid-19 outbreak, and the Russian Invasion of Ukraine. In addition, the chosen time frame was decided based on data availability and with the purpose of minimizing any data disruption associated with the 2001 military conflict.	- Bank-Specific Variables: - Total Volume of Gross Loan - Macroeconomic Variables: - GDP - Interest Rate - Unemployment Rate - Aggregate data for the whole Banking system	Not Applicable	Quantitative Method (ARDL Approach)	The study reveals that GDP has a negative and statistically significant effect on NPLs. Meanwhile, the NPLs have been positively impacted by the unemployment rate and the interest rate. However, it was determined that gross loans did not have any influence on NPLs in both the short and long term.	This study could expand its scope to include additional countries beyond the current ones. For example, neighboring countries like Bulgaria and Croatia underwent a similar process of joining the European Union (EU). Therefore, analyzing these countries could offer valuable insights into potential shifts in patterns of emigration for employment opportunities and inflows of capital and remittances from abroad following their accession to the EU.

Naili and Lahrichi (2022)	The research sample consists of 53 banks from non-GCC nations in the MENA region, including Morocco, Tunisia, Egypt, Jordan, and Turkey. The datasets cover the time period from 2000 to 2019, providing data for each year.	- Bank-Specific Variables: 1) Bank Size 2) Capital Adequacy Ratio 3) Bank Performance (ROE) 4) Loan Growth 5) Bank Inefficiency 6) Ownership Concentration 7) Diversification - Macroeconomic Variables: 1) GDP Growth 2) Inflation Rate 3) Public Debt 4) Unemployment Rate - Industry-Specific Variables (Concentration - CR3)	Bad management Hypothesis, skimming theory, sovereign debt theory and Franchise value theory	Quantitative Method (Dynamic Panel Data through GMM-STATA 14)	This study finds that bank-specific factors like size, capital adequacy, inefficiency, and diversification are negatively associated with NPLs, while performance and ownership concentration have a positive impact. Among macroeconomic variables, inflation, public debt, and unemployment positively influence NPLs, while GDP growth has a negative effect. Industry concentration (CR3) exhibits a negative association with NPLs.	One limitation of this study is the relatively small sample size of banks and the inclusion of data up to a specific period. Expanding the sample to include a larger number of banks and extending the analysis to a more recent period could improve the study's robustness and relevance. Future research could address this limitation to offer a more comprehensive understanding of the subject.
Zulkifli and Ahmad (2022a)	Analysis of 26 Malaysian Commercial Banks from 2007 to 2020.	- Bank-Specific Variables: 1) Return on Assets 2) Loan Growth 3) Loan to Asset	Not Applicable	Quantitative Method (Panel Static - Random Effect Model)	Microeconomic variables such as Return on Assets (ROA), Loan Growth (LG), and Loan to Assets (LTA) have significant effects on NPLs. However, NPLs are	The findings are context-specific to Malaysia. It's essential to acknowledge that economic conditions, banking practices, and crisis impacts can differ across countries.

		4) Non-Interest income • Macroeconomics Variables: 1) GDP 2) Interest Rate 3) Unexpected Crisis (Dummy Variable) • Commercial Banks			not significantly influenced by GDP and interest rates.	Thus, the generalizability of the results to other regions or global contexts might be limited. Additionally, the discussion should address the quality and reliability of the data used for analysis. Data issues, such as missing or inaccurate information, can introduce biases and affect the validity of the results.
Lee, Chen, Chang and Chen (2022)	This study uses a panel dataset of 32 listed Taiwanese companies to evaluate the link between a bank's NPL ratio and firm value. The analysis covers from 2008 to 2015.	• Macroeconomic Variable: 1) GDP Growth 2) Manufacturing Production Index • Control Variable: 1) Assets Size • Firm's Corporate Governance Variables: 1) Share Collateralize Director 2) Related Party Transaction • Financial Policy Variables:	Not Applicable	Quantitative Method (Estimates using Non-linear Least Squares and Considering the Individual-specific Fixed-Effect Non-dynamic PSTR Model):	The results suggest that macroeconomic variables such as GDP growth and the Manufacturing Production Index have a significant negative association with Bank NPLs. Additionally, the control variable (asset size) exhibits a negative relationship with NPLs. In terms of firm corporate governance variables, both SCD and RPT show a significant positive association with NPLs. Finally, among the financial policy variables, only financial leverage demonstrates a positive relationship with NPLs, while interest protection multiples and firm coverage	Not Applicable

		1) Interest Protection Multiple 2) Lending Firm Leverage 3) The Coverage Ratio of the firm • Conventional Bank			ratio exhibit a negative association.	
Osunkoya, Ikpefan and Olokoyo (2023)	This study focusses on Nigeria Banks from the years 1981 to 2019.	• Macroeconomic Variables: 1) Unemployment Rate 2) GDPG 3) Inflation Rate 4) Exchange Rate	Adverse Selection Theory, and Asymmetry Theory	Multivariate Econometric Technique which are ARDL Model	This study shows that there is a positive relationship between the NPLs with GDPG and Exchange Rate in Nigerian Banks. Meanwhile the inflation and unemployment are insignificant.	Not Applicable
Khouangvichit (2024)	This study focusses on Lao Bank in which it will cover from the year Q12012 to Q42021	• Macroeconomic Variables: 5) Money Supply(M2) 6) Minimum Loan Rate 7) Consumer Price Index 8) Nominal Exchange Rate	Not Applicable	Vector Error Correction Model	This study shows that there is a long-term relationship between NPLs towards the Lending rate and money supply which the NPLs tend to raise along with these two variables. Meanwhile, only interest rates are to be found to have a short-term impact towards NPLs.	The unavailability of data

Pandey (2024)	This study focusses on Nepal in which it will cover 18 private and 3 state owned commercial bank in Q22007 to Q12023.	- Macroeconomics Variables: 1) Real GDPG 2) Bank Polic Rate 3) Inflation Rate - State Owned and Private Banks	Credit Risk Theory	ARDL Model	The finding shows that NPLs are higher in State-owned Banks than the private banks. Besides, this study shows that inflation has shown negative and significant results. Meanwhile, the Bank Policy Rate shows positive results.	Not Applicable
Sing, Hosin, Mohamad, and Bawazir (2024)	This study used annual data which covers the period from 2007 to 2021.	- Macroeconomic Variables: 9) GDP Growth 10) Lending Rate 11) Central Bank Policy Rate 12) Unemployment Rate 13) Growth Rate of Residential Property Prices. 14) Inflation Rate 15) Domestic Currency per US dollar - Commercial Bank and Islamic Banks	Not Applicable	Utilizing the ARDL method in the analysis.	It shows that in the long run from model 1 only GDPG is negatively significant, while the lending rate and Unemployment rate is positively significant. Meanwhile, in model 2 its shows that only the central bank policy and exchange rate is significantly positive. As for the Errors Correction regression results its shows that in model 1 and 2 are negatively significant.	Inaccurate lag duration can cause model misconception which can lead bias result.

2.5 Hypotheses Development

The primary objective of this study is to determine the relationship between macroeconomic factors (Unemployment Rate, Gross Domestic Product Growth, Inflation Rate, Lending Interest Rate, and Exchange Rate) and unexpected crises (Global Financial Crises and Covid-19 Pandemic), NPLs in conventional Malaysian banks. The Null Hypothesis (Ho) states that no positive association exists between NPLs, macroeconomic factors, and unexpected crises. Meanwhile, the alternative hypothesis (H1) implies a positive association between NPLs, macroeconomic factors, and unexpected crises in Malaysian conventional banks. Therefore, below is the hypothesis for each variable in this study:

Table 2.9
Hypotheses Development

Hypothesis 1 Unemployment Rate	Ho: There is no significant relationship between Unemployment Rate and NPL H1: There is a significant relationship between Unemployment Rate and NPL
Hypothesis 2 Gross Domestic Product Growth	Ho: There is no significant relationship between NPL and GDPG H1: There is a significant relationship between NPL and GDPG
Hypothesis 3 Inflation Rate	Ho: There is no significant relationship between Inflation Rate and NPL H1: There is a significant relationship between Inflation Rate and NPL
Hypothesis 4 Lending Interest Rate	Ho: There is no significant relationship between Lending Interest Rate and NPL H1: There is a significant relationship between Lending Interest Rate and NPL
Hypothesis 5 Exchange Rate	Ho: There is no significant relationship between Exchange Rate and NPL H1: There is a significant relationship between Exchange Rate and NPL
Hypothesis 6 Global Financial Crises	Ho: There is no significant relationship between Global Financial Crises and NPL H1: There is a significant relationship between Global Financial Crises and NPL
Hypothesis 7	Ho: There is no significant relationship between COVID-19 Pandemic

2.6 Conceptual Framework

A conceptual framework serves as a fundamental structure that directs research study design, implementation, and interpretation. It gives researchers an overview of their investigation by describing the major ideas, factors, relationships, and presumptions that underpin the study. Therefore, in this study, below is the Conceptual Framework, which covers the relationship between macroeconomic determinants and Unexpected Crises towards the NPLs in Malaysian conventional banks, along with the underpinning theory of each variable:

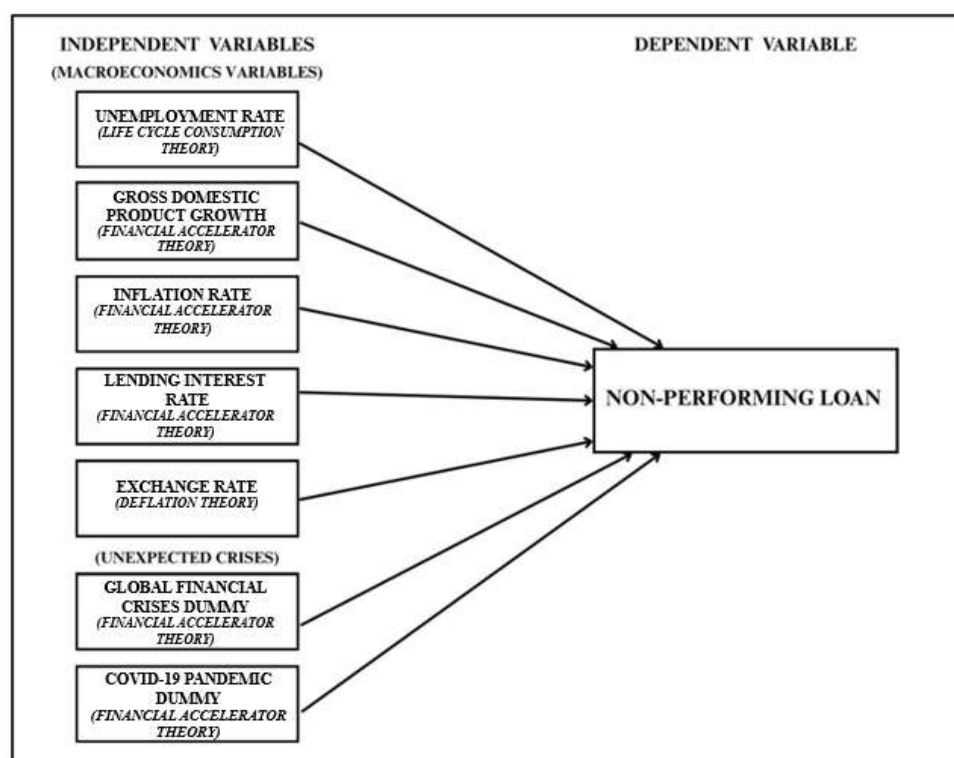


Figure 2.4 Conceptual Framework

2.7 Summary of Chapter Two

In this chapter, the researcher analysed and uncovered the relationship between NPLs and macroeconomic factors such as the unemployment rate, GDPG, inflation rate, lending interest rate, and exchange rate as well as unexpected crises like the GFC and the COVID-19 pandemic by reviewing numerous past studies. This approach aimed to achieve the study's objective and minimize confusion. Analysing various studies provided the researcher with a deeper understanding of the relationships between variables. Each variable in past studies was examined using different data periods and methodologies. This variation enabled a comprehensive comparison and evaluation of findings, ultimately contributing to the attainment of robust results in the researcher's study concerning the relationship between dependent and independent variables.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides a comprehensive overview of the research methodology employed in the study, including detailed discussions on data collection methods, variable measurement, sampling techniques, diagnostic tests, and selection criteria for panel regression models. Besides that, it also establish the foundation for understanding the subsequent research approach and analysis in the forthcoming sections.

3.2 Sample Selection and Data Collection

The data for this study will be collected through secondary sources, employing a quantitative approach. Based on this study, information will be sourced from the annual reports of 17 conventional banks for the Dependent variable (NPL) and the World Bank and IMF Databases for the Independent Variables (Macroeconomic Variables). Meanwhile, for the GFC and the COVID-19 Pandemic, the researcher will be using dummy variables in the analysis. The selection of these banks is contingent upon data availability, ensuring a comprehensive, balanced dataset for analysis. Also, quantitative methods offer distinct advantages, including a well-defined theoretical framework and the presentation of numerical statistics. These attributes lend credibility to the findings, satisfying both academic standards and non-experts' expectations. Specifically, the quantitative approach is poised to uncover robust empirical evidence regarding the subject matter. Thus, the emphasis of this research will be on 17 conventional banks in Malaysia between 2002 and 2023. The timeline below gives a comprehensive analysis of various economic cycles, including the GFC, and the latest COVID-19 outbreak.

Next, the researcher chose the variables for the present study by looking at results from other studies and gaps in the existing research. The researcher wanted to look at critical macroeconomic factors that have been shown to affect NPLs and areas that have yet to be examined thoroughly in earlier research. Given this, the researcher included

factors that have yet to be fully explored in previous studies, like the exchange rate. However, it is important to remember that not all factors can be included because of a lack of data. For example, this study excluded factors like domestic credit and public debt because it needed more data on them, even though they might have been significant to be carried included in this analysis.

Besides, the choice to focus only on Malaysia was made because of the knowledge that each country's economy is different, which can have a significant effect on how NPLs perform. This study aims to fill a significant gap in the existing research on Malaysia's banking sector by providing in-depth studies that are still needed. By focusing on Malaysia, the researchers hope to give a more complete picture of how macroeconomic factors as well as unexpected crises such as the GFC and the COVID-19 Pandemic, affect NPLs given the country's specific economic situation. This focused method lets us dig deeper into the complicated world of Malaysia's banks, giving policymakers, conventional Malaysian banks, and future researchers who will do the same studies helpful information.

Table 3.1
Data Description Source

Variables	Acronym	Definition/Frequency	Source	Expected Sign
Non-Performing Loan	NPL	NPLs to Gross Loans/ Annual	Bank Annual Reports	NA
Unemployment Rate	UNEMP	Unemployment total (% of total Labour Force)/ Annual	IMF Database	(+)
Gross Domestic Product Growth	GDPG	GDP Growth/ Annual	World Bank Database	(-)
Inflation Rate	INFL	Inflation, Consumer Price (Annual%)/ Annual	World Bank Database	(+)
Lending Interest Rate	LIR	Lending Interest Rate/ Annual	World Bank Database	(+)
Exchange Rate	EXC	Real Effective Exchange Index/ Annual	World Bank Database	(+)

Global Financial Crises	GFC	Dummy variable that takes the value 1 during the crisis and 0 otherwise.	NA	(+)
COVID-19 Pandemic	PDC	Dummy variable that takes the value 1 during the crisis and 0 otherwise.	NA	(+)

Table 3.1 shows the data description and the expected signs for each relationship in this study. The table presents various variables, such as the unemployment rate, GDP Growth, inflation rate, lending interest rate, exchange rate, Global Financial Crisis, and the Covid-19 pandemic. All these variables, except GDP growth, are expected to have a positive relationship with NPLs. This indicates that as these factors worsen, the level of NPLs in the banking sector is anticipated to increase. In Contrast, GDP growth is expected to have a negative relationship with NPLs, as stronger economic conditions generally enhance borrowers' ability to repay loans.

Besides That, this study suggests that high unemployment and inflation decrease borrowers' income and purchasing power, while increasing interest rates increase borrowing costs, hence constraining borrowers' capacity to fulfil repayment obligations, resulting in increased NPLs. The exchange rate is expected to show a positive correlation with NPLs, as depreciation could raise the cost of foreign currency-denominated loans, hence increasing repayment for borrowers. Moreover, both the GFC and the Covid-19 pandemic triggered economic disturbances, leading to increased defaults in NPLs. Conversely, GDP growth is anticipated to exhibit an inverse correlation with NPLs, as enhanced economic conditions often boost borrowers' financial stability and repayment capacity, hence decreasing defaults.

Moreover, in this study, NPLs are measured using the NPLs to gross loans ratio. The unemployment rate is defined as the percentage of the labour force that is unemployed, whereas GDP growth is the country's overall economic growth rate. Inflation is measured using the Consumer Price Index (CPI), while the lending interest rate is measured by the lending rate in the banking sector. The Real Effective Exchange Rate (REER) is used to measure the exchange rate, which takes into account currency shifts in relation to a basket of major market partners' currencies. In addition, for the

NPL proxy, this study combines both ringgit-denominated loans and foreign currency-denominated loans to fully capture overall loan performance in the banking industry.

Furthermore, the adoption of REER is appropriate and consistent with the study's aims since it captures the larger impact of exchange rate movements on both foreign currency loans and Ringgit-denominated loans. The REER calculates the current value of the Malaysian Ringgit relative to a basket of major currencies, adjusting for inflation gaps to provide a more comprehensive analysis of currency movements. For foreign currency loans, the MYR's depreciation raises the repayment burden, potentially leading to increased NPLs. Although Ringgit-denominated loans are less immediately affected by exchange rate fluctuations, the REER nevertheless sheds light on broader economic pressures such as inflation and interest rates, which affect borrowers' ability to repay loans. As a result, adopting REER aligns well with the study's macroeconomic objective, capturing the impact of both foreign currency fluctuations and domestic economic conditions on NPLs in Malaysia's banking system.

Lastly, in this study, dummy variables are used to represent the Global Financial Crisis (GFC) and the Covid-19 pandemic (PDC), both of which were categorical events that happened at certain times. Categorical data are variables that divide observations into separate types or groups, with no implied numerical order. Dummy variables are commonly used for categories like gender, geography, or colour, but they are also suitable for event-based categories such as the GFC and PDC. These occurrences can be classified as "happening" or "not happening" at certain moments in time. For example, a dummy variable for the GFC is coded as 1 for 2007-2008 (the crisis year) and 0 for all other years, but the PDC dummy is entered as 1 for 2020-2021 and 0 for all other years. The inclusion of dummy variables for the GFC and PDC is appropriate because both occurrences are distinct and occur within well-defined timeframes. Though the GFC and PDC were brief events, they were distinct economic shocks that had major effects on borrowers' ability to repay loans. Using dummy variables, we can isolate and analyse the effect of these events on NPLs, capturing their distinct impact while keeping other variables constant. As a result, using dummy variables to represent these categorical time-bound events is suitable since it helps quantify the unique effects of the GFC and PDC on NPLs, although the events themselves were temporary.

3.3 Description and Measurement of Variables

This study investigates NPL relationships and selected independent variables in 17 Malaysian conventional banks. Underpinning theories and previous studies showed significant correlations between independent variables and NPLs, resulting in these variables being selected. Besides that, variables are also determined based on literature gaps, such as the Exchange rates. Thus, by analysing these distinct determinants, the researchers expect to better understand conventional bank NPL patterns in Malaysia.

3.3.1 Dependent Variables

The NPL is the only dependent variable in this study. The researcher gathered data on NPL from 17 Malaysian conventional Banks' annual reports which cover both local and foreign banks in their analysis. Besides that, numerous studies have commonly employed the NPLs ratio to measure credit risk (Mohamed et al. 2021; Vaicondam et al. 2019; Zainol et al. 2018; Zulkifli and Ahmad 2022a). Therefore, the measurement of the NPL is as follow:

$$\text{Non – Performing Loan Ratio} = \frac{\text{NPL}}{\text{TOTAL LOAN}} \times 100 \quad (3.1)$$

3.3.2 Independent Variables

3.3.2.1 Unemployment Rate

First, the macroeconomic factor influencing the NPLs is the unemployment rate. The unemployment rate measures people in the labour force who are currently unemployed and actively seeking a job. Besides that, the unemployment rate is a lagging indicator, meaning it rises or falls in response to the changes in the economy rather than anticipating them. Unemployment will increase when the economy is in bad shape, and due to that, people's ability to repay their loans will be affected since they have no money to repay. According to the study by Gambera (2000), the unemployment rate is a frequently used metric of the economy and a significant predictor of NPLs. Therefore, the measurement of the unemployment rate is as follows:

$$\text{Unemployment Rate} = \frac{\text{NUMBER OF UNEMPLOYED PEOPLE}}{\text{TOTAL LABOR FORCE}} \times 100 \quad (3.2)$$

3.3.2.2 *Gross Domestic Product Growth*

In this study, the research includes the influence of GDPG on NPLs. GDPG assesses the rate at which a country's economy is increasing or falling over time. It works as a critical metric of economic performance, with positive growth representing economic expansion and negative growth suggesting contraction or recession. According to the study by Gorter and Bloem (2002), one of the primary drivers of the rise of NPLs is the misuse of loans in an economy. Therefore, a drop in GDP indicates that the economy is shrinking, which is bad news for companies and workers who may lose their employment and borrowers' capacity to repay debts. Therefore, the measurement of the GDP Growth is as follows:

$$\text{Gross Domestic Product Growth} = \frac{\text{GDP}_1 - \text{GDP}_0}{\text{GDP}_0} \times 100 \quad (3.3)$$

3.3.2.3 *Inflation Rate*

Next, the Inflation rate contributed to influencing the NPLs. Inflation is a rate that measures the rise in the fundamental level of goods and services price. In other words, inflation refers to a country's consumer price index rising by a specific rate. Thus, if there is a price rise, the NPLs will be connected because consumers will have less money to fulfil their debt payments if they spend more on household goods and services. According to the previous study, the NPLs indicate a positive relationship with the inflation rate (Kepili et al. 2021; Mohamed et al. 2021). However, a few studies also found that NPLs and Inflation rates were not connected (Mahyoub and Said 2021; Zainol et al. 2018). Meanwhile, a few studies found a significant negative correlation between these variables. Therefore, the measurement of the inflation rate is as follows:

$$\text{Consumer Price Index} = \frac{\text{MARKET BASKET OF DESIRED YEAR}}{\text{MARKET BASKET OF BASE YEAR}} \times 100 \quad (3.4)$$

3.3.2.4 Lending Interest Rate

Lending Interest Rates reflect the fees that lenders charge borrowers when borrowing financial resources. During financial crises, when banks raise interest rates, NPLs increase because higher rates raise borrowers' repayment costs. As a result, studies by Ciukaj and Kil (2020), Nargis et al. (2019) and Zainol et al. (2018) all revealed a positive association between lending interest rates and NPLs. However, several studies, such as those conducted by Sun and Purwanto (2021), had negative findings. Meanwhile, Zulkifli and Ahmad's (2022a) study is statistically insignificant. Therefore, the measurement of lending interest rate is as follows:

$$\text{Lending Interest Rate} = \frac{\text{TOTAL INTEREST PAID}}{\text{PRINCIPAL LOAN AMOUNT} \times \text{LOAN TERM (IN YEARS)}} \times 100 \quad (3.5)$$

Where:

Total Interest Paid: Total interest paid over the loan duration. All borrower interest payments to the lender are included.

Principal Loan Amount: This is the initial amount of money borrowed from the lender, also known as the principal. It excludes loan interest and fees.

Loan Term (In Years): Duration of the loan.

3.3.2.5 Exchange Rate

The Exchange Rate has a significant impact on NPLs. It indicates the customers' price when purchasing foreign items in their home currency. When a nation imports many items, demand for foreign currency grows, increasing the exchange rate. This raises the cost of imported items for consumers, reducing market demand and lowering the value of the country's currency compared to others. Consequently, the CPI may rise, resulting in an increase in NPLs in conventional banks. For example, Zain et al. (2020) discovered a positive relationship between exchange rates and NPLs in the banking industry. Therefore, below is the measurement for the Exchange Rate:

$$\text{Real Effective Exchange Rate} = \frac{\text{NOMINAL EFFECTIVE EXCHANGE RATE}}{\text{RELATIVE PRICE LEVEL}} \times 100 \quad (3.6)$$

Besides that, since the data variable is not normal, the researcher will transform the Real Effective Exchange Rate into a Natural Logarithm. Therefore, the formula for the Natural Logarithm is stated below:

$$y = \ln(x) \quad (3.7)$$

3.3.2.6 *Unexpected Crises*

The researcher will include the Unexpected Crises as the dummy variables in this study. The unexpected crises that the researcher include are the GFC in 2007-2008, and the recent Global COVID-19 Pandemic that started in December 2019. These events are significant as they can create economic instability and hinder the country's development (Basit and Sulaiman, 2017; Lee and Rosenkranz, 2020). Therefore, it is set to 1 if a crisis occurred that year and zero if not.

3.4 Empirical Models

The empirical model specification, derived from previous studies such as Anita et al. (2022), Mohamed et al. (2021), Vaicondam et al. (2019), and Zulkifli and Ahmad, (2022a) are used to investigate the relationship between and key macroeconomic indicators such as unemployment Rate, GDPG, Inflation Rate, Lending Interest Rate, Exchange Rate and also unexpected Crises which are the GFC and COVID-19 Pandemic. Thus, the model can be described as follows:

$$\begin{aligned} NPL_{i,t} = & \beta_0 + \beta_1 UNEMP_{i,t} - \beta_2 GDPG_{i,t} + \beta_3 INF_{i,t} + \beta_4 LIR_{i,t} + \beta_5 \ln(EXC)_{i,t} \\ & + \beta_6 GFC_{i,t} + \beta_7 PDC_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (3.8)$$

Where,

NPL	= Non-Performing Loan
UNEMP	= Unemployment Rate
GDPG	= Gross Domestic Product Growth
INF	= Inflation Rate
LIR	= Lending Interest Rate
ln (EXC)	= Natural Logarithm of Exchange Rate

GFC	= Global Financial Crises
PDC	= COVID-19 Pandemic
β_0	= Constant
β_1 to β_7	= Coefficient of Variables
ε	= Error Term
i	= Banks/Sample
t	= Year

3.5 Estimation of Procedure

The empirical analysis presented here is based on panel data. Following data collection, a descriptive analysis will be conducted to evaluate the normality of each variable. When variables are not normally distributed, the researcher will use natural logarithmic transformations to ensure data consistency and normalisation. Multiple unit root tests will be used to identify the order of integration, including the Levin, Lin, and Chu (LLC) test, the Breitung test, and the Harris-Tzavalis Test. Besides, since the data is focused on balanced data these tests are suitable. At the same time, this test can help to determine the stationarity of all variables. Understanding how sample size and statistical robustness influence the choice of unit root tests is critical. The study next estimate the Panel Data Regression Model (PDRM), followed by the Hausman Test and Diagnostic Testing to assess model validity and reliability.

3.5.1 Panel Data

Panel data is created by combining cross-sectional and time series data. As a result, the datasets for panel data in this study will focus on Malaysia's 17 conventional banks across 21 years, including the GFC and COVID-19 Pandemic years. Panel data offers several advantages, including its ability to account for unobservable variables such as cultural impacts or differences in business practices across organizations, as well as time-varying characteristics within entities (Baltagi, 2013). Also, panel data provides a more significant number of observations and greater independence (Hsiao 2014). Other than that, in contrast to time series analysis, panel data analysis has the potential to address concerns related to autocorrelation and multicollinearity, thus

improving the precision of econometric estimates (Hsiao, 2014).

Besides that, a balanced panel is a dataset in which each participant is seen an equal number of times, generally denoted by the letter 'T.' Meanwhile, an imbalanced panel dataset, designated as 'Ti', is created when people are monitored at various intervals. As a result, the researcher used balanced datasets in this study. Balanced datasets provide multiple advantages, including statistical efficiency, resilience, ease of interpretation, increased statistical power, lower selection bias, appropriateness for panel data analysis, and ease of management. These benefits help to produce consistent and relevant findings from studies in various sectors.

3.5.2 Descriptive Statistics

The study utilizes descriptive statistics to summarize the sample and measured variables, including mean, minimum, and maximum percentages. These statistics assess data normality through measures of skewness and kurtosis, with abnormal data confirmed using the Jarque-Bera test. In non-normal distribution cases, researchers may transform variables into logarithmic form to enhance data normality and consistency.

3.5.3 Skewness and Kurtosis

Skewness and Kurtosis are used for the normality test. In research, assessing the normality of data is critical for establishing the validity of inference processes, specification tests, and forecasting. This is because non-normal data has an impact on the results of panel heteroscedasticity tests (Montes-Rojas and Sosa-Escudero 2011). Thus, panel data is an appropriate test to determine if the data obtained has a normal distribution curve in which the researcher may perform skewness and kurtosis tests on each variable.

Besides, skewness indicates the degree of asymmetry within it. A positive skewness indicates that the distribution is right-skewed, while a negative skewness indicates that the distribution is left-skewed. On the other hand, the Kurtosis statistic is used to assess if a distribution is peaked or flat compared to a normal distribution. Positive values indicate that the tails are heavier and the peak is more prominent, while negative values indicate that the tails are lighter and the shape is more balanced. Thus, in this test, the Jarque Bera Test is used to ascertain whether or not the skewness and

kurtosis of a dataset match the values that are expected from a normal distribution that is provided.

3.5.4 Unit Root Test or Stationarity Test

The Panel Unit Root Test is used to determine if data is stationary or non-stationary. According to Mahadeva and Robinson (2004), the Panel Unit root is critical for avoiding substantial difficulties with non-stationary regression since the resulting standard errors are biased. In addition, if the variables are not stationary at levels. In such a situation, the unit root test exists, and the variables must be transformed into first and second differences until they either have no unit root test or are stationary. As a result, the LLC, Breitung tests, and Harris-Tzavalis Test were utilized in this research because they can accurately identify the panel data's stationary nature. Also, since the researcher will use the balanced data, it will be more suitable to use this panel unit root test.

Besides that, if a researcher or study runs data for a panel unbalanced data set, the researchers can utilise the ADF and Phillips, Perron, and Fisher type tests (Baltagi 2013; Wooldridge 2002). These data are sufficient for testing the stationarity. However, if the data is balanced, this method could yield deceptive results. Also, using balanced data is crucial because it can improve the performance of machine learning algorithms, particularly those sensitive to class distribution, by lowering the potential risk of model bias toward the majority class. This can lead to more accurate predictions and improved generalization of previously unidentified data (Chawla et al. 2002). Therefore, below is the description of each test the study will use, which are the LLC, Breitung, and Harris-Tzavalis Test:

3.5.4.1 *Levin-Lin-Chu (LLC)*

The LLC test is a statistical approach in econometrics that determines whether variables in panel datasets are stationary or non-stationary at the unit root. Besides, the LLC test compares the null hypothesis of a standard unit root in the panel against the alternative of stationarity when cross-sectional units are independent. The first test used in this research is the LLC, developed by Levin, Lin, and Chu (2002). Thus, to utilize this test, the panel data sample size must be relatively adequate, ranging from 10 to 250,

and the observation number must be between 25 and 250. Also, to achieve steady data, we must reject the null hypothesis. Thus, the theory is presented below:

Ho: The data is not stationary (p-value < 0.05) $\rightarrow$ Reject Null Hypothesis

H1: The data is stationary (p-value > 0.05) $\rightarrow$ Fail to Reject Null Hypothesis

3.5.4.2 *Breitung Test*

The Breitung test, developed by Breitung (2000), is used to determine the presence of a unit root in panel data. The LLC test is designed to prevent power loss in panel unit-root testing. Breitung further asserts that their test has the ability to generate more power compared to the LLC test. Also, this test is usually used to counter the homogeneous alternative and this test is based on the p-value where it should be less than 0.05. It indicates that when the p-value is less than 0.05, the null hypothesis is rejected. Therefore, the hypothesis can be shown below:

Ho: The data is not stationary (p-value < 0.05) $\rightarrow$ Reject Null Hypothesis

H1: The data is stationary (p-value > 0.05) $\rightarrow$ Fail to Reject Null Hypothesis

3.5.4.3 *Harris-Tzavalis Test*

Harris and Tzavalis (1999) provided a comparable but more straightforward test. In comparison to an alternative with a single stationary value, this also has a null hypothesis of a unit root. It is intended to be used with data sets that are somewhat limited in time. To offer relatively precise adjustments for small values, they severely constrain the model to exclude the augmenting lags. Thus, if the original panel is balanced (as required), it will remain that. They also assume homogenous variance, whereas the Levin-Lin test does not. Therefore, the hypothesis can be shown below:

Ho: The data is not stationary (p-value < 0.05) $\rightarrow$ Reject Null Hypothesis

H1: The data is stationary (p-value > 0.05) $\rightarrow$ Fail to Reject Null Hypothesis

3.5.5 Breusch Pagan Lagrange Multiplier Test

The Breusch-Pagan LM (BPLM) test detects cross-sectional dependence in panel data models by assessing whether error terms from distinct entities are related. If the null hypothesis of no cross-sectional dependency is rejected, it means that such reliance exists, which might result in skewed or inefficient findings when conventional panel data estimators are used. Researchers use the BPLM test to detect and resolve any cross-sectional dependency concerns, hence assuring the validity and reliability of their panel data analysis. Thus, a p-value greater than 0.05 in the BPLM test indicates that data pooling is adequate, allowing for Pooled OLS analysis.

3.5.6 Hausman Test

The Hausman test is essential for choosing a random or fixed effects model for panel data analysis. The Hausman test's null hypothesis indicates the random effects model, whereas the alternative hypothesis proposes fixed effects.

Besides that, the underlying premise of a random effects model is that independent variables have no bearing on unobserved heterogeneity, often known as individual-specific effects. The results show that the changes in the dependent variable are completely at random and have nothing to do with the elements that may explain them. Contrarily, fixed effects are associated with independent variables in the fixed effects model. Disparities among individuals affected by explanatory variables are likely to be systemic.

Moreover, the Hausman test aids researchers in selecting a model by contrasting the coefficients of random effects with fixed effects. The random effects model may not be reliable and could favour the fixed effects model if there are large discrepancies in the coefficients. The random effects model might be applicable if the coefficients are not significantly different. By determining whether there is a correlation between independent variables and individual-specific effects, the Hausman test aids researchers in panel data analysis when deciding between fixed effects and random effects models.

Ho: The model is a Random effect

H1: The model is a Fixed effect

3.6 Diagnostic Testing

A variety of statistical processes are used in diagnostic testing to assess the assumptions, performance, and suitability of statistical models. These inspections guarantee the model's validity and dependability by revealing any flaws it may have. Researchers provide diagnostic tests such as the Multicollinearity Test, Heteroscedasticity Test and Autocorrelation/Serial Correlation to help in this process. Therefore, below is a description of how each test works:

3.6.1 Multicollinearity Test (Variance Inflation Factor Test)

The VIF (Variance Inflation Factor) test identified multicollinearity in the multiple regression model. Akinwande et al. (2015) revealed that multicollinearity does not occur if the VIF is 1, but may occur if it is larger than 1. A 5–10 VIF implies significant correlation, which may be problematic. Also, if the VIF is above 10, multicollinearity may have caused erroneously estimated regression coefficients, which should be treated. Some studies believe multicollinearity occurs when the VIF exceeds 10 (Shrestha, 2020). Thus, the general VIF rule for this type is:

VIF > 10 = Severe multicollinearity Problem

VIF < 10 = Not suffer multicollinearity Problem

Hence, removing highly correlated variables from the model is one way to deal with extreme multicollinearity. Since variables with a high VIF imply multicollinearity, Akinwande et al. (2015) discovered that removing specific variables did not have any significant impact on R^2 . However, it did assist in mitigating the problem of multicollinearity, as these variables provided redundant information. When the VIF is high, it means that the model's independent variables are highly collinear or multicollinear. Here is one way to estimate the VIF:

$$VIF_j = \frac{1}{1-R_j^2} \quad (3.9)$$

3.6.2 Heteroskedasticity Test

Modified Wald Test analysis was introduced by Hungarian Analyst Abraham Wald. The modified Wald test is used to analyse whether the data exhibits heteroskedasticity or homoscedasticity. Heteroskedasticity in statistics refers to the inconsistent standard deviations of a predicted variable across different independent variable values. Heteroskedasticity can be either conditional or unconditional. Conditional heteroskedasticity is a measure of non-constant volatility that resembles past volatility. In this test, a P-value of less than 0.05 ($P < 0.05$) indicates an issue with heteroskedasticity and requires treatment. To treat heteroskedasticity, robustness techniques such as heteroskedasticity-robust standard errors (vce (robust)), clustering standard errors, Weighted Least Squares (WLS), or Generalized Least Squares (GLS) can be applied. These techniques help to ensure that the regression results remain valid despite the presence of heteroskedasticity. Therefore, in this analysis, the researcher uses the robustness techniques, which are the clustering standard errors.

The clustering method is used to correct heteroskedasticity and serial correlation in panel data by adjusting standard errors within clusters, ensuring more reliable statistical inference. In panel datasets, observations within the same group (e.g., banks) are often correlated, leading to biased standard errors if not properly accounted for. Clustering corrects this by allowing for arbitrary correlation within groups while assuming independence across groups. Unlike standard heteroskedasticity-robust errors, clustering addresses both heteroskedasticity and serial correlation, making it a preferred method in econometrics. This technique enhances the robustness of regression results, ensuring that significance levels and confidence intervals are correctly estimated.

Besides that, this violation of the classical assumption presents a condition known as group-wise heteroskedasticity. Testing for group-wise heteroskedasticity in the model can be tested using the modified Wald Test, which is based on the residual of the fixed effect regression model as defined below:

$$w = \sum_{i=1}^{Ng} (\hat{\sigma}_{it}^2 \frac{\hat{\sigma}^2}{v_i})^2 \quad (3.10)$$

Where,

w = Modified Wald test statistic

N_g = Number of groups (in this case, banks)/total number of banks.

$\hat{\sigma}_{it}^2$ = Estimated variance for group i at time t .

$\hat{\sigma}^2$ = Overall variance across all groups.

v_i = Degrees of freedom adjustment for group i .

$i-1$ to N_g = Each individual group (bank), starting from the first group ($i=1$)

$\sum$ = Summation symbol/ the expression for each group.

3.6.3 Serial Correlation / Autocorrelation Test

Serial correlation, also known as autocorrelation, measures the relationship between a time series and its lagged values, measuring how past results influence subsequent ones. In regression analysis, serial correlation in the error terms breaks the notion of independence, leading to inefficient estimates and inaccurate statistical findings. To identify serial correlation, different tests can be performed, including the Durbin-Watson (DW) test and the Breusch-Godfrey (BG) test. However, for panel data models, the Wooldridge test (Wooldridge, 2002) is widely used due to its ease and stability. In this study, the Wooldridge test is applied to examine the presence of serial correlation. If the p-value is below 0.05 ($p < 0.05$), it shows the presence of serial correlation in the model, requiring corrective steps such as clustered standard errors or GLS to ensure valid statistical inferences.

3.6.3.1 Wooldridge Test

According to Drukker (2003), the Wooldridge test, originally proposed by Wooldridge (2002), is a widely used method for detecting serial correlation in panel data models. This test is particularly useful in identifying whether error terms are correlated over time, which can lead to inefficient estimates and misleading statistical inferences if unaddressed. Drukker (2003) further evaluated the Wooldridge test by applying it to a one-way linear panel-data model with serial correlation and found that it performs effectively in detecting autocorrelation, particularly when sample sizes are

sufficiently large. However, he stated that bigger samples may be necessary to achieve ideal power in the face of conditional heteroskedasticity. If the p-value of the Wooldridge test is below 0.05, it supports the presence of serial correlation in the panel data model. To treat this problem, robustness methods such as clustered standard errors can be applied, as they account for both heteroskedasticity and within-group serial correlation, ensuring more accurate statistical reasoning. Alternatively, GLS can be used to directly model the correlation structure, improving the efficiency and precision of coefficient values.

3.7 Panel Data Regression Model Estimator

Panel data estimation techniques are widely used in research because they can account for the effects of unobserved or missing variables. Also, it offers increased efficiency by combining cross-sectional and time series data, which leads to a more precise parameter estimation. As a result, three different kinds of panel regression models are briefly described: pooled OLS models, fixed effect models, and random effect models. Besides that, in this section, the researcher will also explain static panel data, which is why this study employed static panel data rather than dynamic panel data.

3.7.1 Static Panel Data

Static panel data analysis enables the examination of cross-sectional and time-series variation in data while considering individual bank effects. This approach is well-suited for exploring the simultaneous relationships between macroeconomic factors and NPLs across Malaysian conventional banks during a specific period. However, if the researcher aims to delve into lagged effects or how NPLs influence future macroeconomic performance, a dynamic panel data analysis approach would be more appropriate. Since this study primarily focuses on examining contemporaneous relationships, static panel data analysis suffices for our objectives.

Therefore, in this study the researcher will conduct the static panel data. A static panel data will include the Pooled OLS, Fixed Effect, and Random Effect which will be explained later. These estimators make different assumptions about the nature of unobserved heterogeneity and the relationship between the independent and dependent variables, which are in line with the researcher's objectives. Also, if it is

decided to use static panel data analysis, it would not use system GMM or difference GMM estimators. These estimators are specific to dynamic panel data analysis and are designed to address issues such as endogeneity and serial correlation in the panel data context. Thus, the static panel data models are shown below:

$$Y_{it} = X_{it}\beta + \alpha_i + V_{it} \quad (3.11)$$

$I = 1, \dots, N \text{ (individual)}, t = 1, \dots, T \text{ (time)}$

In panel data analysis, the parameter vector β represents the relationship between variables, while α_i signifies unobserved individual-specific time-invariant effects (fixed effect), and V_{it} denotes the residual disturbance term with specific statistical properties. Two main models emerge based on the nature of α_i : the Random Effects and Fixed Effects models. In the Random Effects model, α_i is treated as a random variable, assumed to be uncorrelated with v_{it} and regressors (X_{it}). This allows for efficient estimation of β using GLS. Conversely, in the Fixed Effects model, α_i is considered an individual fixed parameter, necessitating the within-group estimator for parameter estimation. This estimator effectively removes individual effects from consideration, allowing for unbiased estimation of β .

3.7.1.1 Pooled Ordinary Least Squares

OLS is a well-known statistical and econometric approach for estimating the parameters of linear regression models. Besides that, Pooled OLS is one in which data from different units are pooled together with no assumption of individual differences. Pooled models combine data from multiple units with no assumption of individual differences and are produced by gathering random samples from a large population at several times. Although the random samples are gathered independently of one another, they do not have to be equal in size and will often include different statistical units at various periods in time.

$$y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \varepsilon_{it}(u_i=0) \quad (3.12)$$

3.7.1.2 *Fixed and Random Effect*

The panel data model combines both cross-sectional and time-series data, offering a comprehensive view of phenomena over time. In section 3.5.6 (Page 103-104), the Hausman Test is highlighted as a crucial measure to determine whether to employ Random Effect or Fixed Effect models.

Besides that, in fixed effects scenarios, the model assumes distinct intercepts for individual groups over time, while random effects assume varying disturbances for individual groups/time (Park 2011). Various specific models, such as one-way and two-way models, emerge from blending different effects groups and time properties. One-way models encompass fixed group effects, fixed time effects, random group effects, and random time effects models, while two-way models include fixed group and time effects, and random group and time effects models. Selection among these models is crucial (Park, 2011).

Furthermore, in choosing between fixed effects and random effects models for panel data analysis, researchers adopt a systematic approach. Initially, they conduct the BPLM test to assess model fit. If the test rejects the null hypothesis ($p\text{-value} < 0.05$), indicating panel effects, the Random Effects model is favoured over OLS. Subsequently, the Hausman test evaluates estimator efficiency. If the test suggests the fixed effects model is more efficient ($P\text{-value} < 0.05$), researchers opt for it. Meanwhile, if the test lacks significance ($P\text{-value} > 0.05$), the random effects model may be chosen. This methodical approach aids researchers in making informed decisions based on individual-specific effects and estimator efficiency.

3.8 Statistical Software

The researcher utilizes STATA 18 as the sole statistical software in the current study. STATA is widely preferred among researchers working with panel data due to its comprehensive set of built-in features for straightforward model estimation and testing. Many academics rely on this statistical software to analyze coefficient parameters using a variety of statistical and econometric techniques. Besides that, STATA offers the flexibility to conduct various tests, including the BPLM test and the Hausman test, using commands or the fixed option. These tests are crucial for assessing assumptions and model specifications in panel data analysis. Also, STATA provides

options for addressing heteroscedasticity issues, such as robust standard errors, which enhance the reliability of statistical inference.

3.9 The Flow of Research Methodology

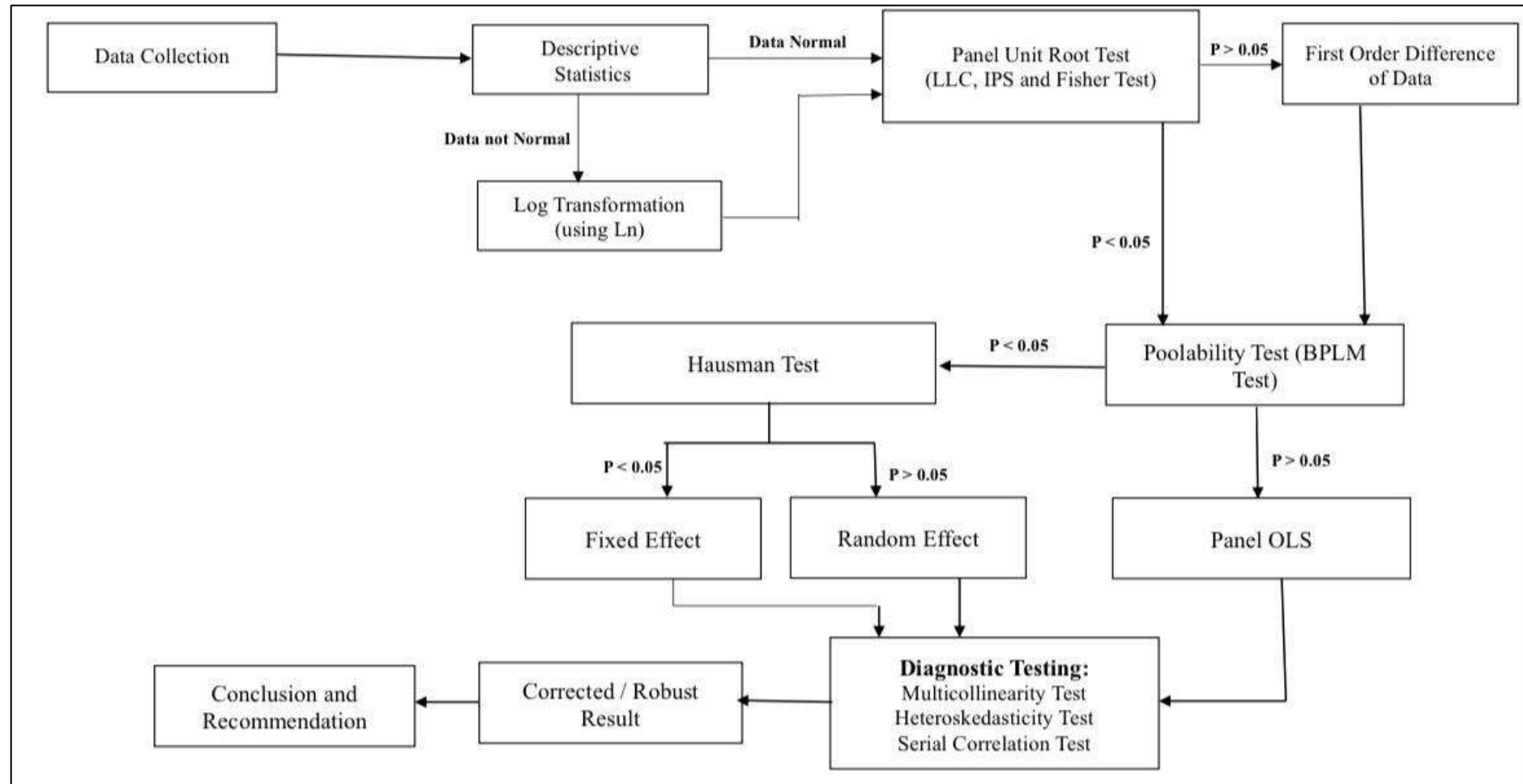


Figure 3.1 The Flow of Research Methodology

3.10 Summary of Chapter Three

This chapter discusses the procedures and analyses data for the study. It commences with a description of the methods for sample selection and data acquisition. The methodology section then describes the approach utilised, particularly in applying panel data analysis. Following this, an in-depth discussion of the examined variables is presented, accompanied by a particular discussion of the empirical model and methods used for estimation. Also covered in detail in this chapter is the estimator employed for the panel data regression model. Lastly, this section provides a framework for the research process, and the software applications utilised for data analysis, thereby showing the methodology and approach of the study.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the study's empirical findings, tests the proposed conceptual framework, and addresses the research questions. The analysis is conducted using STATA 18, building on the methodologies discussed in the previous chapter. Also, this chapter will report the analysis, which starts with the descriptive statistics provided to outline the characteristics of each variable, including their skewness and kurtosis. Next, this is followed by unit root testing, which employs the Levin-Lin-Chu, Breitung, and Harris-Tzavalis tests to examine data stationarity. Then, the Breusch-Pagan Lagrange Multiplier (BPLM) test is applied to assess whether the Pooled Ordinary Least Squares (OLS) or the random effect model is more suitable for this data. Meanwhile, the Hausman specification test is performed to identify the best model from Random Effects (RE) and Fixed Effects (FE). Lastly, this chapter finishes with diagnostic tests such as multicollinearity, autocorrelation, heteroskedasticity, and the final regression result.

4.2 Descriptive Statistics

Descriptive statistics refer to statistics that may be used to display, summarize, and interpret data in a study. This form of statistics can aid in comprehending the aggregate qualities of a data sample's components.

Table 4.1
Descriptive Statistics Analysis for the Dependent and Independent Variables

Variables	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
NPL	4.1843	5.4242	0	54.2263	3.9429	26.8037
UNEMP	3.4693	0.4209	2.8750	4.6500	1.4644	5.0004
GDPG	4.6489	2.8932	-5.4568	8.8618	-2.1697	8.0145
INFL	2.1583	1.3461	-1.1387	5.4408	0.0146	3.7232
LIR	5.1340	0.8739	3.4441	6.5283	0.1192	2.0726
LnEXC	4.5263	0.0745	4.3827	4.6393	-0.3990	1.8158
GFC	0.0909	0.2879	0	1	2.8461	9.1000

PDC	0.1364	0.3436	0	1	2.1193	5.4912
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Notes: Non-performing loans (NPL), unemployment rate (UNEMP), gross domestic product growth (GDPG), inflation rate (INFL), lending interest rate (LIR), natural logarithm of the exchange rate (LnEXC), Global Financial Crises (GFC), Pandemic Covid-19 (PDC).

Table 4.1 reports the descriptive statistics of the variables used in the regression analysis. Key figures are reported, including mean, standard deviation, Min, Max, skewness, and kurtosis values. First of all, all variables comprise 374 observations. The purpose of Descriptive Statistics analysis for both dependent and independent variables is to provide an initial understanding of the distribution and spread of the data and to ensure the normal distribution of all variables used in the analysis. This foundational step helps interpret the underlying patterns and characteristics of the variables, allowing for a clearer understanding of their behaviour. Besides, when the assumption is violated, the interpretation and inference may not be reliable or valid.

The mean provides insight into the central tendency of a variable by averaging its values during the study period. Table 4.1 shows that the Lending Interest Rate (LIR) possesses the highest mean at 5.1340, signifying that interest rates were comparatively higher on average. GDP Growth (GDPG) comes next with an average of 4.6489, indicating modest economic growth. Next, with a mean of 4.5263, the Natural Logarithm of the Exchange Rate (LnEXC) indicates a reasonably steady exchange rate. Meanwhile, it follows the NPLs variable, which shows the general degree of unfavourable loans in the banking system, with a mean of 4.1843. However, the Inflation Rate (INFL) averages 2.1583, indicating a modest degree of price stability. The Unemployment Rate (UNEMP) has a mean of 3.4693, showing general employment patterns. Meanwhile, as for the crisis-related variables, which include the Global Financial Crises (GFC) and Pandemic Crises (PDC), using binary data shows the mean values of 0.0909 and 0.1364, respectively. The mean of 0.0909 for GFC indicates that the GFC occurred 9.09% of the time (2007-2008), while the mean value of 0.1364 for PDC indicates that the COVID-19 Pandemic occurred 13.64% of the time (2020-2021).

Besides that, Standard deviation is a statistical measure showing the spread or dispersion of data points around the mean in a data set. It helps to show how far particular values are from the general average. A low standard deviation indicates consistency or stability since the data points are tightly concentrated around the mean. Meanwhile, a high standard deviation means the data points are farther apart, indicating

more variability or risk. Usually, a lower standard deviation is desirable since it indicates more consistent and reliable results. Therefore, in this analysis, the NPLs have the largest standard deviation (5.4242) as the dependent variable, indicating significant swings due to economic crises and financial stability adjustments. This is followed by the standard deviation of GDPG of 2.8932, indicating significant economic fluctuation due to global and domestic triggers. Next, the INFL fluctuates moderately (1.3461), reflecting price variations. Also, a standard deviation of 0.8739 indicates relative stability and moderate monetary policy responsiveness for LIR. However, the UNEMP has a low standard deviation (0.4209), indicating higher stability across the study period. Lastly, the LNEXC has the lowest standard deviation (0.0745), suggesting low exchange rate volatility and making it the most favourable variable. On the other hand, the GFC and PDC dummy variables have moderate standard deviations of 0.2879 and 0.3436, respectively, indicating their vulnerability yet significance.

Next, as shown in Table 4.1, the minimum value for NPL is 0, which is consistent with the annual report of Bank of China (Malaysia) Berhad. This report indicates no NPL during the financial year ending 31 December 2003 (2002: Nil). Similarly, the GFC and Pandemic COVID-19 dummy variable has a minimal value of 0, resulting from the binary nature of the data utilized in this study. Among the other variables, GDPG records a minimum value of -5.4568, reflecting periods of negative economic growth, while INFL shows a minimum of -1.1387, indicating instances of deflation. For the LnEXC, the minimum value is 4.3827, which suggests a relatively stable exchange rate. The LIR has a minimum value of 3.4441, and the UNEMP shows a minimum of 2.8750.

Moreover, the maximum value is recorded by NPL, with a value of 54.2263, indicating the highest level of NPLs observed during the study period. This is followed by GDPG, which reaches a maximum value of 8.8618, and LIR, with a maximum value of 6.5283. The INFL has a maximum value of 5.4408, while the UNEMP shows a maximum of 4.65. The LnEXC records a maximum value of 4.6393. Lastly, the GFC and Pandemic COVID-19 dummy variables have a maximum value of 1, reflecting the binary nature of the data used in this study.

Furthermore, one of the key objectives of descriptive statistics is to assess whether the data conforms to normality. The data distribution is evaluated in this study using skewness and kurtosis. According to Table 4.1, the skewness values for most variables are within an acceptable range, generally between -2 and +2, indicating a

reasonably normal distribution. However, the skewness value for NPL is far higher than this range. The character of financial data, which frequently contains outliers or extreme numbers, explains this discrepancy. Rajan and Zingales (1998) claimed that financial statistics often show skewed distributions since different companies' sizes and performance reflect systematic differences in economic situations. High skewness could mean that the data is not normal, but this is normal for financial data and does not always mean that the results are incorrect, especially if the factors stay the same and the proper statistical methods are used.

Lastly, in terms of kurtosis, a value of three suggests a normal distribution (mesokurtic). Less than 3 (platykurtic) indicates a distribution with thinner tails (fewer extreme values), whereas greater than 3 (leptokurtic) indicates a distribution with heavier tails (more extreme values). Kurtosis is usually more than 3 in financial datasets since financial data usually shows "fat tails" caused by outliers or significant events. Hence, this is not necessarily a problem but reflects the underlying nature of the data. Based on Table 4.1, in this study, variables such as NPL, UNEMP, GDPG, and INFL show a kurtosis greater than 3, with NPL having the highest kurtosis at 26.8037, UNEMP at 5.0004, GDPG at 8.0145, INFL at 3.7232, GFC at 9.1000, and PDC at 5.4912. On the other hand, the LnEXC and LIR had kurtosis values below 3. A kurtosis value below 3 (platykurtic) suggests these variables have a flatter distribution with fewer extreme values than a normal distribution. This is not necessarily a problem but indicates a relatively stable distribution without many outliers, which can be expected in stable economic or financial datasets.

4.3 The Results of the Unit Root Test

As mentioned earlier in the previous chapter, the researcher used three types of unit root tests methods, known as Levin Lin Chu (LLC), Breitung and Harris-Tzavalis (HT) tests. The null hypothesis (H_0) of LLC, Breitung and HT indicates the presence of a unit root or non-stationary data, whereas the alternative hypothesis (H_1) indicates that the data does not exhibit a unit root or it is stationary data. Therefore, the confidence level in the research is at 90%, 95% and 99% where it shows the significance at 10%, 5% and 1% of the confidence interval. In the unit root test, the researcher recommends choosing 99% and a 95% confidence level. In order to reject the null hypothesis, the p-value of the result must be less than the confidence interval.

Table 4.2
The Results of Unit Root Test

	At Level	1 st Difference	2 nd Difference
NPL			
LLC	-15.8040***	N/A	N/A
Breitung	3.0331	-4.8200***	N/A
Harris-Tzavalis	0.5864***	N/A	N/A
UNEMP			
LLC	-5.7262***	N/A	N/A
Breitung	-7.9908***	N/A	N/A
Harris-Tzavalis	0.6217***	N/A	N/A
GDPG			
LLC	-11.5185***	N/A	N/A
Breitung	-12.6784***	N/A	N/A
Harris-Tzavalis	-0.0135***	N/A	N/A
INFL			
LLC	-8.5352***	N/A	N/A
Breitung	-12.6008***	N/A	N/A
Harris-Tzavalis	-0.0010***	N/A	N/A
LIR			
LLC	-5.9460***	N/A	N/A
Breitung	-1.9134**	N/A	N/A
Harris-Tzavalis	0.7926***	N/A	N/A
LnEXC			
LLC	2.3455	-7.9813***	N/A
Breitung	4.3076	-6.3179***	N/A
Harris-Tzavalis	0.9373	0.2037***	N/A

Note: No asterisk (*) means that the result is not statistically significant. *, **, and *** indicate significance levels of 10%, 5%, and 1%, respectively.

Table 4.2 shows that most variables are already stationary, as they reject the null hypothesis (H_0), confirming that most of the panel dataset does not exhibit unit roots. The first-panel unit root test, LLC, rejects the 99% significance level null hypothesis for all variables except LnEXC, indicating stationarity. However, the Breitung test finds that NPL and LnEXC are not significant at the level, while the Harris-Tzavalis test finds that LnEXC is not significant at the level. Despite this, variables like NPL are found to be stationary in at least two of the three tests. However, the LnEXC is not stationary at the level for all tests. Hence, the researcher conducted the first difference, which results in all tests for LnEXC significance. Other than that, for consistency, an additional first-difference test was performed, which further

confirmed stationarity across all variables, reinforcing the robustness of the results. Therefore, based on the overall results from the three-panel unit root tests, the study confirms that all variables, except LnEXC, can be considered stationary at the level.

4.4 Breusch Pagan Lagrange Multiplier Test (BPLM) and Hausman Test

These tests enable the identification of a suitable estimating technique for panel data. The Breusch-Pagan Lagrange Multiplier (BPLM) test assesses whether panel-specific effects exist, supporting Random Effects over Pooled OLS. On the other hand, the Hausman test guarantees that the selected model is consistent and not influenced by the correlation between the regressors and the individual effects by comparing the Fixed Effects and Random Effects models.

Table 4.3
The Result for BPLM Test and Hausman Test

BPLM Test	Hausman Test
100.40	0.00
0.0000	1.0000

The BPLM Test generates a p-value of 0.0000, below the 0.05 significance level. This outcome implies that the Random Effects model is more suitable than the Pooled OLS model, hence rejecting the null hypothesis. Also, the Hausman Test shows a p-value of 1.0000, meaning the null hypothesis cannot be rejected. This result confirms the choice of the Random Effects model over the Fixed Effects model. Thus, depending on both tests, the Random Effects model is the most appropriate for this study.

4.5 Diagnostic Check

4.5.1 The Results on Multicollinearity Test

A multicollinearity test uses the Variance Inflation Factor (VIF) as part of the diagnostic checking. This sub-section elaborates on the results of the multicollinearity test. A common rule of thumb suggests that a VIF value of less than 10 indicates that the model does not suffer from a multicollinearity problem. The results show that the mean VIF for all variables is 3.09. Since this value is below 10, the independent

variables are not highly correlated and do not suffer from multicollinearity (Hair et al., 1995). However, suppose multicollinearity was present, such as a variable with a VIF of 10 or higher. In that case, the affected variable should be removed from the analysis because one approach to addressing extreme multicollinearity is eliminating highly correlated variables. A high VIF indicates strong collinearity among independent variables, which can distort regression estimates.

Table 4.4

The Results of Variance Inflation Factors (Multicollinearity Test)

Variable	VIF
PDC	6.39
UNEMP	5.40
LIR	2.91
GDPG	2.31
INFL	1.78
GFC	1.72
DLNEXC	1.13
Mean VIF	3.09

4.5.2 Heteroskedasticity Test

Heteroskedasticity occurs when the regression model error term variance varies across observations. Groupwise heteroskedasticity in panel data analysis occurs when error variance changes between groups (e.g., banks) yet remains constant over time. The homoscedasticity assumption violation can lead to inefficient estimates and erroneous statistical findings. To avoid inaccurate hypothesis testing and standard error reliability issues, heteroskedasticity must be identified. The modified Wald test detects heteroskedasticity with a chi-square statistic of 4902.96 and a p-value of 0.0000, below 0.05. This result rejects the null hypothesis of homoscedasticity, confirming heteroskedasticity in the model. Thus, to overcome this issue, the researcher uses clustered standard errors, a robustness technique that accounts for dataset heteroskedasticity and serial correlation. This adjustment ensures that standard errors are correctly estimated, enhancing the reliability and validity of the regression results in the output table.

Table 4.5
The Result of Heteroskedasticity Test

Model: Heteroskedasticity (Modified-Wald Test)	
Chi-Square	4902.96
Prob > Chi-Square	0.0000

4.5.3 Autocorrelation Test / Serial Correlation

The researcher uses the Wooldridge test to detect the presence of autocorrelation/ serial correlation presence. The null hypothesis of the Wooldridge test indicates that there is no serial correlation. Meanwhile, the alternative hypothesis suggests a serial correlation in the model regression. If the p-value is less than 0.05, it indicates the presence of serial correlation and necessitates corrective action. Based on the data, the p-value is less than 0.05, which is 0.0000, showing that the data suffers from serial correlation. To solve this issue, this study employs a robustness technique to ensure the validity of statistical results.

Table 4.6
The Result of Autocorrelation Test

Model: Autocorrelation Test (Wooldridge Test)	
F (1,16)	14.674
Prob > F	0.0015

4.6 Static Panel Data Analysis: Regression Result

A static panel data model is commonly used in empirical research to examine relationships between variables over time while assuming that the effects of explanatory variables on the dependent variable remain constant. Unlike dynamic panel models, which include lagged dependent variables to capture past effects, static panel models focus on contemporaneous relationships without considering past values of the dependent variable. In this study, a static panel data regression is employed to investigate the relationship between macroeconomic factors, unexpected crises, and NPLs among Malaysian conventional banks. The main objective is to determine how macroeconomic indicators and unexpected crises influence NPL levels. Since diagnostic tests reveal the presence of heteroskedasticity and serial correlation in the

model, a robustness technique is applied to ensure reliable statistical inferences. The regression results provide insights into key macroeconomic determinants of NPLs and the impact of global crises on the banking sector. The estimated regression results are as follows:

Table 4.7

The Results for Pooled OLS, Random Effect, and Corrected Analysis

Variables	Pooled OLS	Random Effect	Corrected Hetero and Serial Correlation
CONSTANT	-21.5397*** (3.1336)	-21.5397*** (2.8781)	-21.5397*** (4.5787)
UNEMP	2.2093** (0.9969)	2.2093*** (0.9087)	2.2093*** (0.3585)
GDPG	0.3281*** (0.0950)	0.3281*** (0.0866)	0.3281*** (0.0522)
INFL	-0.5146*** (0.1793)	-0.5146*** (0.1634)	-0.5146*** (0.1922)
LIR	3.3340*** (0.3758)	3.3340*** (0.3426)	3.3340*** (0.7853)
DLNEXC	-16.2052*** (6.2325)	-16.2052*** (5.6807)	-16.2052** (6.7621)
GFC	-2.0585*** (0.8247)	-2.0585*** (0.7516)	-2.0585*** (0.5314)
PDC	1.6850 (1.3327)	1.6850 (1.2147)	1.6850*** (0.6317)
R-Squared	0.3224	0.3224	0.3224
Adjusted	0.3089	-	-
F-Statistics	23.73	-	-
Root MSE	0.0000	-	-
Wald Chi2	3.4868	199.92 0.0000	56.68 0.0000
BPLM Test		100.40 0.0000	
Hausman Test		0.00 1.0000	
Multicollinearity Test (VIF Test)		3.09	
Heteroskedasticity (Modified-Wald Test)		4902.96 0.0000	
Autocorrelation Test (Wooldridge Test)		14.674 0.0015	
Observations	374	374	374

Notes: Unemployment rate (UNEMP), Gross Domestic Product Growth (GDPG), Inflation Rate (INFL), Lending Interest Rate (LIR), Natural logarithm of the exchange rate (LnEXC), Global Financial Crisis (GFC), Oil Crisis (OIL), and Pandemic Crisis (PDC). Figures in parentheses represent standard errors. ***, **, and * indicate

significance at the 1%, 5%, and 10% levels, respectively. BPLM represents Breusch and Pagan Lagrangian Multiplier Test whereas VIF represents Variance Inflation Factor.

The table above presents the regression results for Pooled Ordinary Least Squares (OLS), Random Effects (RE), and the model adjusted for heteroskedasticity and serial correlation. The BPLM test revealed a p-value less than 0.05. This test evaluates the suitability of the Pooled OLS compared to the Random Effects model. Since the p-value is below 0.05, the null hypothesis is rejected, indicating a preference for the Random Effects model over the Pooled OLS model. Meanwhile, the Hausman specification test revealed a p-value greater than 0.05, leading to the acceptance of the null hypothesis. This indicates the random effect model is preferred over the Fixed Effects approach. Besides that, a diagnostic check revealed that the data suffers from heteroskedasticity and serial correlation. As for multicollinearity, the researcher runs the VIF, which shows results below 10, which is 3.09, indicating that multicollinearity is not an issue. However, the Modified Wald Test detected heteroskedasticity, as shown by a p-value below 0.05. This confirms that the model suffers from heteroskedasticity and needs to be treated. Similarly, the Wooldridge test for serial correlation shows a p-value below 0.05, confirming the presence of serial correlation, which also needs to be treated. Thus, the researcher applied the cluster-robust standard error correction to account for both heteroskedasticity and serial correlation. This adjustment improves the reliability of the regression results.

Besides, Table 4.7 shows that all variables are statistically significant in this study's final results. Firstly, UNEMP has a significant positive correlation with NPLs, with a coefficient of 2.2093 at a 99% confidence level, showing that increased unemployment leads to higher NPLs. This relationship suggests the essential influence of labor market stability on borrowers' repayment ability. As unemployment rises, many individuals experience a reduction or complete loss of income, hindering their financial ability to meet debt repayment obligations. Consequently, debtors may prioritize fundamental life needs, like sustenance, accommodation, and medical care, over debt repayment, resulting in delayed payments or loan defaults. This finding aligns with the Life Cycle Consumption Theory, which argues that individuals optimize their consumption in relation to anticipated lifetime income. When unemployment abruptly interrupts revenue streams, borrowers may depend on savings

or loans to sustain spending. Nonetheless, if unemployment continues and financial reserves are inadequate, borrowers may find it challenging to meet their debt obligations, thereby increasing the probability of loans becoming non-performing. In the meantime, GDPG has a positive correlation of 0.3281 at a 99% significance level (***), indicating a link between economic growth and increasing NPLs, presumably due to riskier lending during boom periods. This finding suggests that banks may become proactive and engage in increased lending activities during periods of economic expansion, periodically lowering their credit assessment standards. Consequently, debtors with higher risk profiles may be given loans, which could ultimately result in increased default rates. Adverse selection and moral hazard are plausible causes for this phenomenon. Moral hazard arises when borrowers assume that favorable economic conditions will persist or that potential losses can be reduced after obtaining loans, thereby undertaking an excessive amount of financial risk. Meanwhile, adverse selection occurs when banks are unable to accurately differentiate between high-risk and low-risk debtors, particularly during periods of rapid credit expansion. As a result, the likelihood of loan defaults in the future may be elevated as riskier debtors are more likely to secure loans.

Other than that, LIR has a positive coefficient of 3.3340, which is significant at 99% (***), indicating that higher lending rates may lead to larger NPLs due to higher borrowing costs. This connection indicates that an increase in lending rates increases borrowing costs, hence imposing increased financial strain on borrowers to fulfill their repayment responsibilities. As interest payments increase, borrowers—especially households and organizations with limited financial reserves—may encounter challenges in debt service, thereby increasing the probability of loan defaults. This discovery can be explained by the Financial Accelerator Theory, which states that changes in financial conditions can intensify economic volatility through the credit market. This hypothesis argues that increased interest rates impair borrowers' balance sheets by raising debt servicing expenses and decreasing their net worth. Meanwhile, DLNEXC showed a negative coefficient of -16.2052, significant at 98% (**), demonstrating an inverse association between currency changes and NPLs. The negative and significant correlation for DLNEXC suggests that a greater ringgit may lower foreign-denominated debt repayment costs and business import costs, helping borrowers repay their loans. In addition, currency appreciation may signal good economic fundamentals and market confidence, reducing banking credit

risk. Besides that, the negative coefficient of -0.5146, significant at 99% (***), suggests that inflation is linked to the inverse of NPLs. For companies, increasing costs could increase nominal income, therefore simplifying debt repayment. From a more general viewpoint, though, inflation helps companies control their NPLs and lowers the actual value of debt, lightening the repayment load, especially for fixed-interest loans.

Lastly, this study's results suggest that unexpected crises significantly affect NPLs. Firstly, the GFC is statistically significant at the 99% confidence level, showing a negative value of -2.0585. This indicates that the crisis negatively affected NPLs, meaning that during the GFC, NPLs decreased. This adverse correlation indicates that the GFC did not raise NPLs, which contradicts expected world trends. According to the analysis by Khoon and Mah-Hui (2010) in late 2007, various financial institutions in the United States and around the world suffered significant losses from investments in high-risk financial products, including Collateralised Debt Obligations (CDOs), Credit Default Swaps (CDS), and others. Fortunately, Malaysia's financial institutions had little exposure to these harmful investments. This study showed that Malaysia's financial institutions are better off than during the AFC due to better financial control and monitoring. Thus, this indicates that the country's banking sector was more stable and less affected by the GFC. In contrast, a coefficient of 1.6850 indicates a positive link between the PDC and NPLs, which is significant at the 99% confidence level. This shows that the PDC resulted in a surge in NPLs, most likely due to economic disruptions, lower business income, and job losses during these periods.

4.7 Research Findings and the Achievement of Research Objectives

This section addresses how the research results connect to the study's objectives. The primary objective of this study was to dive into how macroeconomic factors and unexpected crises impact Malaysian banks' NPLs. This research will evaluate how significant macroeconomic factors like unemployment, GDP growth, lending interest rates, inflation, and exchange rates impact NPLs. It also explored how the global financial Crises and pandemic crises impact the quantity of NPLs. Hence, this phase analyses how effectively the research objectives were satisfied by assessing the difference between what was predicted and what resulted from the study.

4.7.1 To investigate the relationship between determinants (Unemployment Rate, GDPG, Inflation Rate, Lending Interest Rate, and Exchange Rate) towards NPLs among Malaysian conventional banks.

The primary objective of this research was to investigate the relationship between macroeconomic variables and NPLs in Malaysian banks. The empirical results, provided in Table 4.7, provide strong evidence that important macroeconomic factors, such as unemployment (UNEMP), GDP growth (GDPG), lending interest rates (LIR), inflation rate (INFL), and exchange rates (DLNEXC), have a significant impact on NPL. Thus, the following table shows a summary of the findings regarding the objective (RO1):

Table 4.8
Summary of Findings for Macroeconomics Variables

Variables	Sign of Coefficient	Coefficient	Significance of Coefficient
UNEMP	+	2.2093	Significance
GDPG	+	0.3281	Significance
LIR	+	3.3340	Significance
INFL	-	- 0.5146	Significance
DLNEXC	-	- 16.2052	Significance

First, according to the results, the UNEMP correlates positively and significantly with NPLs. The result is consistent with expectations, as greater unemployment causes higher NPLs as more people face financial difficulties and struggle to repay their loans. When people lose their jobs, their income decreases, limiting their capacity to satisfy financial obligations such as loan repayments. Even employed individuals may become more cautious about spending and borrowing, limiting total economic activity. Meanwhile, unemployed people prioritise critical needs like food, housing, and healthcare above loan repayments, which increases default rates. Thus, a study conducted by Naili and Lahrichi (2022) supports this argument, claiming that during periods of high unemployment, borrowers are less able or willing to satisfy their financial commitments, resulting in increased NPLs. Also, the authors noted that persons with lower income levels frequently suffer inflated interest rates due to employment instability, limiting their repayment capacity. Next, these results coincide

with the findings from Vaicondam et al. (2019), whose work found a positive and significant correlation between NPLs and unemployment in Malaysia's banking sector between 2009 and 2018. According to their findings, for every one-unit increase in the unemployment rate, NPLs increased by 48.8%, suggesting that unemployed individuals frequently lack the financial capacity to service their loans. Similarly, a recent study by Sing et al. (2024) revealed a positive and significant association between unemployment and NPLs in Malaysia, implying that reduced unemployment is related to the decrease in NPLs. Thus, this finding is supported by other studies, including Huan et al. (2020), Kozarić and Delihodić (2020), Mazreku et al. (2018), and Wairimu and Gitundu (2017). According to Huan et al. (2020), high unemployment means more people without jobs, which increases credit risk because they do not have a consistent income to pay their loans.

Next, the GDPG showed an unexpected result, which was that there was a positive relationship between GDPG and NPLs. This goes against what most people anticipate since GDP growth usually means more jobs, higher incomes, and a better ability to repay loans, all of which should lower NPLs. The positive relationship, however, shows that when the economy grows, credit may grow faster, which could cause banks to lend money in riskier ways. Since banks are experiencing economic improvement, they might lend more money to people and businesses, even those with bad credit. As the economy changes, these borrowers may struggle to meet their repayment responsibilities, leading to more NPLs. Chang et al. (2008), who found a positive and significant link between NPLs and GDP, support their findings. The study found that banks tend to take on more risk when the Brazilian economy grows by giving out more loans. More dangerous loans can lower the quality of all loans, leading to more NPLs. If this happens, GDP and NPL move together. This means that moments of economic growth encourage risky lending, which may boost GDP for short periods but cause more loans to default in the long run. Also, Gashi et al. (2022), Kartikasary et al. (2020), Osunkoya et al. (2023), and Singh et al. (2021) agreed that GDP and NPLs are related in a positive direction. However, despite these results, few new studies have recently been conducted on this relationship, especially in Malaysia. In the future, more studies could be done to see if certain economic conditions, regulatory environments, or distinctions among sectors affect this unusual relationship.

In addition, the results for the loan interest rate are as predicted, revealing significant positive associations with NPLs. This effect is likely because increased interest rates make it more costly for consumers, which makes it harder for them to satisfy their repayment responsibilities. This finding corresponds to the study done by Sing et al. (2024), which is that lower loan rates make it more unlikely that NPLs would grow. Khouangvichit (2024) discovered that LIR had significant effects on NPLs. As lending rates rise, borrowers' ability to satisfy their commitments declines, resulting in more debts not being repaid. Meanwhile, Zainol et al. (2018) found a significant connection between lending rates and NPLs in Malaysia, using the ARDL method on quarterly data from 2006 to 2015. According to the study, an increase in interest rates reduces borrowers' ability to meet their obligations, resulting in higher NPLs. Further, Vaicondam et al. (2019) found a significant positive correlation between loan rates and NPLs in Malaysia from 2009 to 2018, supporting the theory that higher borrowing costs reduce borrowers' ability to meet their financial obligations. On the other hand, other studies, including those by Ahmed et al. (2021), Badar et al. (2013), Castro (2013), Ciukaj and Kil (2020), Golitsis et al. (2022), and Nargis et al. (2019), supported the positive relationship between lending rates and NPLs.

Moreover, contrary to the predicted positive influence, the inflation rate (INFL) shows an unexpected inverse correlation with NPLs. Generally, higher inflation is expected to increase NPLs, as rising expenses decrease customers' purchasing power, complicating their ability to fulfil debt commitments. This finding corresponds with the research conducted by Pandey (2024), in which the researcher found that inflation had a negative impact on NPLs. Similarly, the finding is consistent with the argument that Nkusu (2011) made, which stated that rising prices might lower the actual debt load, making it easier to repay loans. Borrowers can repay their loans more efficiently, and the rate of loan defaults is reduced due to the fall in the value of fixed debt obligations that occur when inflation grows. Also, Gashi et al. (2022) found a significant and unexpected negative correlation between inflation and NPLs in the Western Balkans from 2000 to 2019. Contrary to the authors' assumptions of a positive association, the negative findings may be attributed to the increase in the interest rate to combat inflationary pressure, which makes borrowing more costly. In other words, this approach tries to slow the economy and keep inflation from skyrocketing and decreasing over time. As a result, while inflation is declining, borrowers may need help to repay their obligations, such as loans and mortgages, since they must pay higher

interest rates. The study is supported by the results of Chaibi and Ftiti (2015), who identified a significant and negative correlation in Germany. Also, the research conducted by Anita et al. (2022) and Koju et al. (2018) has shown that the inflation rate has a negative effect on NPLs, which aligns with the results of the previous study. According to the author's analysis, the reason for the negative results is that when inflation rises, the overall worth of loans decreases, hence facilitating borrowers to make punctual payments and reducing the likelihood of default. In addition, research conducted by Mazreku et al. (2018), Mensah and Adjei (2015), and Nargis et al. (2019) has also shown a strong and statistically significant negative association with NPLs.

Lastly, the exchange rate (DLNECX) has a negative and significant relationship with NPLs. Similar to the inflation rate, these results do not align with the findings of many researchers, including the studies by Ahmed et al. (2021), Castro (2013), Chaibi and Ftiti (2015), Kepli et al. (2021), Osunkoya et al. (2023), and Zain et al. (2020), who anticipated a positive correlation. All of these studies thought there would be a positive correlation. The study by Radivojević and Jovović (2017) discovered that declining local currencies lead to greater NPL rates. Similarly, Mensah and Adjei (2015) found that when loans are heavily priced in foreign currencies without sufficient hedging mechanisms, an exchange rate depreciation increases borrowers' repayment burden, mainly if their income is in the local currency. In such circumstances, the cost of foreign currency-denominated debt rises locally, putting borrowers' financial ability under strain and raising the risk of default. These results suggest that changes in the exchange rate could increase credit risk, especially in countries where borrowing in foreign currency is common. This analysis supports Klein's (2013) findings, which also found a negative association between exchange rates and NPLs. The features of the Malaysian banking sector may account for the negative association identified in this study. The local currency issues the majority of loans in Malaysia, which reduces borrowers' direct exposure to exchange rate risk. A depreciation of the Malaysian ringgit may advantage export-orientated businesses by augmenting their revenue in local currency, thus enhancing their loan repayment capability and diminishing the risk of default. As a result, the findings indicate that fluctuations in exchange rates may affect NPLs variably, contingent upon the overall structure of the banking system and the degree of foreign currency exposure among borrowers. This study indicates that in countries with limited foreign currency borrowing, like Malaysia, exchange rate depreciation may not inherently raise credit

risk and could even indirectly enhance borrowers' repayment ability through increased export performance.

4.7.2 To analyze the relationship between the Unexpected Crises (GFC and COVID-19 Pandemic) and NPL among Malaysian conventional banks.

The second objective of this research was to investigate the relationship between unexpected crises and NPLs in Malaysian banks. The empirical data in Table 4.9 show that major economic crises, such as the Global Financial Crisis and the COVID-19 Pandemic, have significant impacts on NPLs. These findings, which are based on binary data, show that crises raise financial hardship and loan default rates. Thus, the table below summarizes the results achieved for Research Objective 2 (RO2).

Table 4.9
Summary of Findings for Unexpected Crises

Variables	Sign of Coefficient	Coefficient	Significance of Coefficient
GFC	-	-2.0585	Significance
PDC	+	1.6850	Significance

First, the study above demonstrates that the GFC negatively correlates with NPLs in Malaysia's banking industry. This implies that Malaysian NPLs were either untouched or dropped due to the GFC. Despite being a global catastrophe, the GFC had little direct influence on Malaysia's financial industry. According to Khoon and Mah-Hui (2010), toxic assets, such as CDS and CDOs, were the primary cause of the crisis, whereas Malaysian institutions were not severely exposed. Also, post-Asian Financial Crisis reforms strengthened Malaysia's banking sector by tightening risk management laws, improving financial monitoring, and increasing capital adequacy ratios. This resilience produced a negative coefficient by shielding the local banking industry from the negative consequences of the GFC. On the other hand, interestingly, this finding greatly differs from previous studies and the expected results, which often found a positive relationship between the GFC and the growth of NPLs. For example, Castro (2013) and Zulkifli and Ahmad (2022a) discovered that the GFC worsened credit risk and caused a rise in NPLs in several nations due to economic contraction, higher unemployment, and fewer opportunities for repayment.

Besides that, this study found that the PDC showed a significant and positive association with the NPLs. This approach is consistent with past research, such as Zulkifli and Ahmad (2022a). Their study revealed that unexpected crises, such as the COVID-19 Pandemic, are among the most important variables influencing NPLs in the banking industry, highlighting how economic shocks from crises deteriorate borrowers' ability to repay loans. The study also indicated that the degree of the crisis erodes banks' trust in publicly servicing loans, as previously suggested, and banks become more cautious when lending during crises. Also, this study is supported by Ari et al. (2021) statement, in which the study provided a dataset on NPL trends throughout 88 financial crises covering the COVID-19 pandemic. Research indicated that higher and unresolved NPL levels were significantly associated with the intensity of post-crisis recessions. Thus, the findings reveal a positive and significant association between the PDC and NPLs since borrowers are more likely to encounter financial hardship during such periods due to income decreases or unemployment.

Table 4.10
Summary of The Findings Discussion

Variables	Findings	Supported
UNEMP	Positive (+)	Huan et al. (2020), Kozarić and Delihodić (2020), Mazreku et al. (2018), Naili and Lahrichi (2022), Sing et al. (2024), Vaicondam et al. (2019), and Wairimu and Gitundu (2017).
GDPG	Positive (+)	Chang et al. (2008), Gashi et al. (2022), Kartikasary et al. (2020), Osunkoya et al. (2023), and Singh et al. (2021).
LIR	Positive (+)	Ahmed et al. (2021), Badar et al. (2013), Castro (2013), Ciukaj and Kil (2020), Golitsis et al. (2022), Khouangvichit (2024), Nargis et al. (2019), Vaicondam et al. (2019), and Zainol et al. (2018).

INFL	Negative (-)	Anita et al. (2022), Chaibi and Ftiti (2015), Gashi et al. (2022), Koju et al. (2018), Mazreku et al. (2018), Mensah and Adjei (2015), Nargis et al. (2019), Nkusu (2011), and Pandey (2024).
DLNEXC	Negative (-)	Klein (2013), Mensah and Adjei (2015), and Radivojevic and Jovovic (2017).
GFC	Positive (+)	Castro (2013) and Zulkifli and Ahmad (2022a)
PDC	Positive (+)	Zulkifli and Ahmad (2022a)

4.8 Summary of Chapter Four

This chapter delivers and examines the empirical findings resulting from the analysis, matching them with the study objectives. The study aimed to investigate the relationship between selected macroeconomic indicators, Unemployment Rate, GDP Growth, Lending Interest Rate, Inflation Rate, Exchange Rate and NPLs while also assessing the impact of unexpected crises, namely the GFC and the COVID-19 Pandemic, on the level of NPLs in Malaysian banks. The regression findings show that all factors included in the model are statistically significant in impacting NPLs. However, some factors provided outcomes that varied from theoretical assumptions and existing empirical research. Specifically, the Exchange Rate, GDP Growth, and Inflation Rate revealed unexpected signs in their association with NPLs. Interestingly, the GFC variable was also statistically significant but had a negative sign, which contradicts most literature that relates financial crises to deteriorating NPL circumstances.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter covers the study's conclusion and recommendations. Section 5.2 highlights the key results and their contributions to the study's implications. Section 5.3 then discusses the significance of the findings for Malaysian conventional banks, policymakers, and the body of knowledge. Lastly, the chapter examines the study's limitations and recommends further study.

5.2 Conclusion

This study has explored the relationship between macroeconomic variables and unexpected crises towards the NPLs in Malaysia, offering valuable insights into the dynamics of credit risk. In this study, all the objectives have been achieved, and all variables are significant. However, in this analysis, although all variables are significant, the results indicated that several variables, such as GDPG, INFL, DLNEXC, and GFC, displayed unexpected results with NPLs, diverging from typical expectations.

Firstly, UNEMP show a positive and significant connection with NPLs, recognising the commonly observed theories that higher unemployment leads to a greater financial threat to borrowers. As unemployment grows, debtors struggle to repay their loans, raising NPLs. This is consistent with the findings of prior research that emphasise the vulnerability of borrowers during economic downturns when loss of employment influences their capacity to service loans. Also, these results are consistent with previous studies and the Life Cycle Consumption Theory. The Life Cycle Consumption Theory explains how unemployment (income disruption) can harm people's capacity to repay debts. When a person loses their employment, their income decreases, and they may struggle to sustain their consumption or make loan payments, resulting in more NPLs.

Besides that, GDP growth was predicted to lower NPLs due to increased financial stability and repayment capacity. However, an unexpected positive link between NPLs was discovered. This implies that during periods of strong GDP growth,

banks may implement more aggressive lending strategies, extending more credit to borrowers. These positive results might be related to increased risky applicants receiving loans. As the economy deteriorates, these borrowers may fail to satisfy their commitments, increasing NPLs. Also, this outcome contradicts most prior research and the Financial Accelerator Theory, which predicts that higher economic development will lower NPLs. On the contrary, these findings appear more consistent with the Moral Hazard Theory since banks and borrowers may engage in riskier behaviours when favourable economic conditions are favourable, assuming that growth would continue or that they will be protected from the negative impacts of defaults.

Moreover, the LIR demonstrated a positive and significant relationship with NPLs. As interest rates rise, the cost of borrowing rises, potentially leading to a higher default rate. Borrowers, particularly those with variable-rate loans, may face higher repayment responsibilities, resulting in more financial difficulty and an increase in NPLs. This study supports the financial accelerator theory, which states that higher interest rates during times of economic hardship make it more difficult for borrowers to repay. Also, when the BNM boosts the OPR, borrowing rates rise, burdening borrowers and contributing to higher NPLs.

Furthermore, contrary to the general view, INFL and DLNEXC demonstrated negative associations with NPLs. Inflation, which is typically assumed to erode buying power and promote defaults, did not show the predicted positive correlation with NPLs. Similarly, the exchange rate was negatively correlated with NPLs. One possible explanation for these odd findings is that while inflation often stimulates consumer spending, it may also diminish the value of fixed debt obligations, reduce borrowers' burdens, and lower default rates. Also, a higher exchange rate may signal a strengthening economy, enhance borrowers' repayment ability while offsetting the negative consequences of inflation and currency volatility. This is similar to Pandey's (2024) and Nkusu's (2011) findings, who stated that rising inflation and exchange rate changes may reduce debt loads in some conditions, resulting in reduced NPLs. Also, a stable or increasing exchange rate assists borrowers by lowering the cost of foreign-denominated loans, thereby easing repayment difficulties, in accordance with the inverse relationship between the exchange rate and NPLs. According to the research conducted by Radivojević and Jovović (2017) and Mensah and Adjei (2015), the cost of foreign currency loans increases as the exchange rate decreases, which in turn worsens the financial circumstances of borrowers and increases the number of NPLs.

Consequently, the findings of this investigation suggest that Malaysia's economic environment, which is characterized by stringent banking regulations and restricted exposure to debt denominated in foreign currencies, has the potential to lessen the adverse impacts of exchange rate fluctuations on NPLs.

The study further showed that the GFC had a negative and significant correlation with NPLs in Malaysia, which is in alarming contrast to the results of various global cases. The banking sector's post-Asian Financial Crisis enhancements and Malaysia's robust regulatory framework are helpful in minimizing the anticipated increase in NPLs during the GFC. The Malaysian banking sector's resilience was a consequence of the higher capital adequacy ratios and the enhanced regulatory supervision by BNM, which shielded Malaysian banks from the most grievous consequences of the global crisis. Meanwhile, the COVID-19 pandemic has shown a significant positive correlation with NPLs, which is in accordance with prior research. The pandemic created severe economic disruptions, lowering borrowers' repayment ability and increasing defaults. The pandemic's impact on NPL shows that borrowers' vulnerability during global crises is still valid and highlights the need for robust crisis management measures.

In conclusion, this study reveals that the relationships between macroeconomic variables and unexpected crises regarding NPLs all achieved the objective and assumption of the study. These findings offer critical implications for policymakers and financial institutions and contribute to the body of knowledge emphasizing the importance of proactive measures to manage credit risk, especially during economic instability

5.3 Implications of the Study

5.3.1 The Malaysian Conventional Banks

The results of this study have significant impacts on Malaysian conventional banks. The unexpected positive relationship between GDP growth and NPLs shows that economic growth does not always mean less credit risk in the banking sector. In return, it shows that when the economy is booming, banks might lower their requirements for lending, which makes their loan portfolios riskier. Hence, Malaysian banks need to improve how they assess credit risk and limit their exposure during times of economic growth. On the other hand, the study discovered a significant correlation between

lending interest rates and NPLs. This shows the relevance of monitoring interest rate changes and how they affect borrowers' capacity to repay their loans. Also, rising interest rates could worsen the financial challenges of debtors who are already experiencing financial hardship, particularly those with variable-rate loans, as they will increase their debt obligations. Hence, banks may offer flexible repayment plans or income-based restructuring options to help struggling debtors. For example, one of the few options can be to extend repayment periods until the debtor's situation improves.

Moreover, the findings reveal that increasing unemployment affects borrowers' ability to repay their loans, hence increasing the likelihood of defaults. This emphasizes the necessity for banks to monitor fluctuations in the labour market and assist borrowers with the risk of unemployment. For example, banks can assist borrowers facing financial difficulties by providing income-driven repayment schemes or temporary moratoriums, not only for certain groups of individuals. On the other hand, inflation and exchange rates exhibit a negative correlation, indicating that loan defaults decrease when inflation is high or when the currency appreciates. Also, this may be attributed to an anticipated increase in export income or an expected rise in purchasing power, which enhances the financial stability of borrowers. Therefore, Malaysian conventional banks should continue to monitor and take action on these vital findings, despite the negative correlation between NPLs, inflation, and exchange rates. Through these findings, it reveals that borrowers may be in a better financial position if inflation is low or the currency is stronger. Therefore, this presents a chance for financial institutions to enhance their lending strategies and preserve the integrity of their assets.

Lastly, the results conclude that Malaysian banks must be institutionally prepared and comply with regulations in order to withstand and recover from unexpected crises like the COVID-19 pandemic and the GFC. Therefore, this study's findings on the correlation between NPLs and the COVID-19 pandemic are encouraging Malaysian banks to adhere strictly to the capital adequacy rules established by the BNM and to strengthen their internal governance systems in order to establish themselves as more financially resilient. Also, in order for banks to be able to react well to unexpected economic shocks, this study also stresses the importance of proactive crisis management measures. For example, to help borrowers who are having trouble making their loan payments during economic downturns, banks could take measures like giving temporary loan moratoriums, financial counselling services, or emergency loan restructuring schemes, especially when facing macroeconomic circumstances such as

unemployment during crises.

5.3.2 The Policymakers

The results indicate that macroeconomic variables and unexpected crises significantly affect NPLs. These findings emphasize the necessity for proactive policy initiatives, especially during times of economic volatility. For example, Policymakers, particularly the BNM, could utilize these insights to improve financial regulations, including Financial Assistance Schemes like Targeted Repayment Assistance (TRA), decreases in the Statutory Reserve Requirement (SRR), and adjustments to the Overnight Policy Rate (OPR). On the other hand, organizations like AKPK should enhance their outreach and restructuring efforts to deliver more targeted debt reduction services during economic downturns.

5.3.3 Body of Knowledge

This study enhances the academic literature by validating and assessing many economic theories in relation to the relationship between NPLs and macroeconomic variables, as well as unexpected crises. For example, the Financial Accelerator theory, deflationary theory, and life-cycle consumption theory employed by the researcher will enhance and give validation to the relationship between variables. On the other hand, the findings can provide evidence and extend the theoretical understanding of NPLs behaviour toward the Macroeconomic variables and unexpected crises. Hence, future researchers may employ the study's findings as a benchmark for international comparisons or lay a solid platform for future research, particularly in countries that are developing or studying post-crisis settings.

5.4 Limitations and Recommendations for Future Studies

First, the limitations of this study, as well as one of the major concerns, are its reliance on secondary data. Although this type of data is important for investigating broad economic patterns, it may not capture the full complexity of macroeconomic conditions or the immediate effects of unexpected crises on the banking sector. This is due to the fact that secondary data does not reflect how people behave or react in specific

circumstances. On the other hand, primary data is obtained directly from individuals via methods such as surveys and interviews. This becomes more difficult when the data used is inconsistent or incomplete, especially if the most recent figures are not yet available such as in the annual report of banks. Hence, these factors can have an impact on the study's reliability and accuracy.

Besides that, a further limitation of the study is that its scope is primarily limited to Malaysian conventional banks. A study on Malaysia's Conventional banks provides a robust comprehensive overview of Malaysia's banking sector. However, it may not be applicable in some countries that have a different nature of framework and economic structure. Therefore, expanding the scope of the research to include more countries would allow for more comparative analysis and a more comprehensive perspective.

Next, future study may examine the impact of hedging strategies, borrowers' foreign currency exposure, and export-driven industries to enhance comprehension of how exchange rate volatility affects credit risk. Also, further studies should differentiate between Ringgit-denominated and non-Ringgit loans when evaluating NPLs to assess the varying effects of exchange rate fluctuations on local and foreign currency borrowing. These studies would expand upon the findings of this research and offer a more thorough comprehension of the macroeconomic factors influencing NPLs.

Furthermore, the research will only evaluate a restricted number of macroeconomic indicators, such as inflation, GDP growth, unemployment, exchange rates, and loan rates. These are only some of the variables that will be evaluated. Even while these characteristics are necessary for understanding the origins of NPLs, credit risk may also be affected by other factors such as political stability, changes in regulatory policies, and shocks from the outside world. It is possible that future research will examine a greater number of variables or make use of a wider variety of econometric models in order to strengthen the robustness of the findings and capture deeper linkages.

Lastly, in order to improve the quantitative analysis, the research could gain an advantage from the use of qualitative data, such as interviews with bank managers or authorities. The qualitative insights may offer a deeper comprehension of the procedures that banks use to make decisions and the strategies that are used to manage NPLs during times of crisis. These insights have more practical results for banking operations.

REFERENCES

- Ahmad, W., Amran, N. H., & Haris, S. (2022). Malaysian Household Debt: The Impact of Covid-19 on Non-Performing Financing. *Management & Accounting Review*, 21(3).
- Ahmed, S., Majeed, M. E., Thalassinou, E., & Thalassinou, Y. (2021). The impact of bank specific and macro-economic factors on non-performing loans in the banking sector: Evidence from an emerging economy. *Journal of Risk and Financial Management*, 14(5), 217. doi: 10.3390/jrfm14050217
- Akinwande, M. O., Dikko, H. G., & Samson, A. (2015). Variance inflation factor: as a condition for the inclusion of suppressor variable (s) in regression analysis. *Open Journal of Statistics*, 5(07), 754.
- Anita, S. S., Tasnova, N., & Nawar, N. (2022). Are non-performing loans sensitive to macroeconomic determinants? An empirical evidence from banking sector of SAARC countries. *Future Business Journal*, 8(1), 7. doi: 10.1186/s43093-022-00117-9
- Ariff, M., & Yanti Abubakar, S. (1999). The Malaysian financial crisis: Economic impact and recovery prospects.
- Ari, A., Chen, S., & Ratnovski, L. (2021). The dynamics of non-performing loans during banking crises: A new database with post-COVID-19 implications. *Journal of Banking & Finance*, 133, 106140.
- Asensio, A. (2018). Insights on deflation theory. *Brazilian Journal of Political Economy*, 38(2), 338–357. doi: 10.1590/0101-31572018v38n02a07
- Attanasio, O. P., & Weber, G. (2010). Consumption and saving: models of intertemporal allocation and their implications for public policy. *Journal of Economic Literature*, 48(3), 693–751.
- Badar, M., Javid, A. Y., & Zulfiquar, S. (2013). Impact of macroeconomic forces on nonperforming loans: An empirical study of commercial banks in Pakistan. *Wseas Transactions on Business and Economics*, 10(1), 40–48
- Bahrudin, W. A., & Masih, M. (2018). Is the relation between lending interest rate and non-performing loans symmetric or asymmetric? evidence from Ardl and Nardl.
- Baltagi, B. H. (2008). Forecasting with panel data. *Journal of Forecasting*, 27(2). <https://doi.org/10.1002/for.1047>

- Baltagi, B. H. (2013). Panel data forecasting. *Handbook of Economic Forecasting*, 2, 995–1024.
- Bank Negara Malaysia. (2015, April 6). Classification and impairment provision for loans/financing. Bank Negara Malaysia.
- Bank Negara Malaysia. (2022). Financial stability review – First half 2022.
- Bank Negara Malaysia. (2024). Bank Negara Malaysia. <https://www.bnm.gov.my/>
- Basit, A., & Soraya Sulaiman, S. (2017). the Impact of Global Financial Crisis 2008 on Banking Sector in Malaysia. *International Journal of Accounting & Business Management*, 5(No.2).
- Browning, M., & Crossley, T. F. (2001). The Life-Cycle Model of Consumption and Saving. In *Journal of Economic Perspectives* (Vol. 15).
- Caprio, G., & Honohan, P. (2002). Banking policy and macroeconomic stability: An exploration (Vol. 2856). World Bank Publications.
- Castro, V. (2013). Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic modelling*, 31, 672-683. <https://doi.org/10.1016/j.econmod.2013.01.027>
- CEIC. (2023). Global economic data, indicator, chart and forecast database: Malaysia non-performing loans (2022 & 2023) [Data set]. CEIC. Retrieved April 10, 2024, from <https://www.ceicdata.com/en>
- Chaibi, H., & Ftiti, Z. (2015). Credit risk determinants: Evidence from a cross-country study. *Research in international business and finance*, 33, 1-16. <https://doi.org/10.1016/j.ribaf.2014.06.001>
- Chang, E. J., Guerra, S. M., Lima, E. J. A., & Tabak, B. M. (2008). The stability-concentration relationship in the Brazilian banking system. *Journal of International Financial Markets, Institutions and Money*, 18(4), 388–397. <https://doi.org/10.1016/j.intfin.2007.04.004>
- Chantararat, S., Lamsam, A., Samphantharak, K., & Tangsawasdirat, B. (2020). Household debt and delinquency over the life cycle. *Asian Development Review*, 37(1), 61–92. https://doi.org/10.1162/adev_a_00141
- Chawla, N. v., Bowyer, K. W., Hall, L. O., & Kegelmeyer, W. P. (2002). SMOTE: Synthetic minority over-sampling technique. *Journal of Artificial Intelligence Research*, 16. <https://doi.org/10.1613/jair.953>

- Ciukaj, R., & Kil, K. (2020). Determinants of the non-performing loan ratio in the European Union banking sectors with a high level of impaired loans. *Economics and Business Review*, 6(1), 22–45. <https://doi.org/10.18559/ebr.2020.1.2>
- Ćorić, B. (2011). The financial accelerator effect: concept and challenges. In *Financial Theory and Practice* (Vol. 35, Issue 2).
- Dhesi, D. (2022, September 5). Banks to rise above challenges. *The Star*.
- Dhesi, D. (2023, September 4). Sale of bad debt by banks forecast to rise. *The Star*.
- Drukker, D. M. (2003). Testing for serial correlation in linear panel-data models. *The Stata Journal*, 3(2), 168–177.
- Espinoza, R., & Prasad, A. (2010). Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects. *IMF Working Papers*, 10(224). <https://doi.org/10.5089/9781455208890.001>
- Gambera, M. (2000). Simple forecasts of bank loan quality in the business cycle (Vol. 230). Federal Reserve Bank of Chicago Chicago, IL.
- Gashi, A., Tafa, S., & Bajrami, R. (2022). The impact of macroeconomic factors on non-performing loans in the Western Balkans. *Emerging Science Journal*, 6 (5), 1032–1045. doi: 10.28991/ESJ-2022-06-05-08
- Golitsis, P., Khudoykulov, K., & Palanov, S. (2022). Determinants of non-performing loans in North Macedonia. *Cogent Business and Management*, 9(1). <https://doi.org/10.1080/23311975.2022.2140488>
- Gorter, N., & Bloem, M. (2002). The macroeconomic statistical treatment of NPLs. Publication of the Organization for Economic Corporation & Development.
- Harris, R., & Sollis, R. (2003). *Applied Time Series Modelling and Forecasting*.
- Hsiao, C. (2014). Panel Macroeconometric Modeling☆ This paper is dedicated to PCB Phillips for his creative and lasting contributions to econometrics. In *Essays in Honor of Peter CB Phillips* (pp. 205–239). Emerald Group Publishing Limited.
- Huan, K. S., Ramasamy, S., Yen, Y. Y., & Pillay, S. D. (2020). European Journal of Molecular & Clinical Medicine Determinants of Credit Risk in Conventional Banks: An Empirical Study in Malaysia. *European Journal of Molecular & Clinical Medicine*, 7(8), 1–25.
- Ikram, M., Shen, Y., Ferasso, M., & D’Adamo, I. (2022). Intensifying effects of COVID-19 on economic growth, logistics performance, environmental sustainability and quality management: evidence from Asian countries. *Journal of Asia Business Studies*, 16(3), 448-471. doi: 10.1108/JABS-07-2021-0316

- Kartikasary, M., Marsintauli, F., Serlawati, E., & Laurens, S. (2020). Factors affecting the non-performing loans in Indonesia. *Accounting*, 6(2), 97-106. doi: 10.5267/j.ac.2019.12.003
- Kepli, S., Bani, Y., Rosland, A., & Laila, N. (2021). Non-Performing Loans and Macroeconomic Variables in Malaysia: Recent Evidence. In *International Journal of Economics and Management Journal homepage* (Vol. 15, Issue 1).
- Kevin, D., & Gyong, Y. E. (2020). Macroeconomic Determinants of Non-Performing Loans: Empirical Analysis of Deposit Money Banks in Nigeria. Article in *International Journal of Social Sciences*, 2(2).
- Khoon, G. S., & Mah-Hui, M. L. (2010). The Impact of the Global Financial Crisis: The Case of Malaysia. In *Third World Network*.
- Khouangvichit, C. (2024). The relationship between macroeconomic factors and non-performing loans (NPLs) in Lao PDR. In *Green and Digital Transitions* (pp. 154–173). Szegedi Tudományegyetem.
- Kjosevski, J., & Petkovski, M. (2021). Macroeconomic and bank-specific determinants of non-performing loans: The case of baltic states. *Empirica*, 48(4), 1009-1028. doi: 10.1007/s10663-020-09491-5
- Klein, N. (2013). Non-performing loans in CESEE: Determinants and impact on macroeconomic performance. *International Monetary Fund*.
- Koju, L., Koju, R., & Wang, S. (2018). Macroeconomic and Bank-Specific Determinants of Non-Performing Loans: Evidence from Nepalese Banking System. *Journal of Central Banking Theory and Practice*, 7(3), 111–138. <https://doi.org/10.2478/jcbtp-2018-0026>
- Koju, L., Koju, R., & Wang, S. (2020). Macroeconomic determinants of credit risks: evidence from high-income countries. *European Journal of Management and Business Economics*, 29(1), 41-53. doi: 10.1108/EJMBE-02-2018-0032
- Kozarić, K., & Delihodić, E. Z. (2020). Effects of Macroeconomic Environment on Non-Performing Loans and Financial Stability: Case of Bosnia and Herzegovina. *Journal of Central Banking Theory and Practice*, 9(2), 5–17. <https://doi.org/10.2478/jcbtp-2020-0011>
- Lawrence, E. C. (1995). Consumer default and the life cycle model. *Journal of Money, Credit and Banking*, 27(4), 939–954.
- Leamer, E. E. (2009). Gross domestic product. *Macroeconomic Patterns and Stories*, 19–38. https://doi.org/https://doi.org/10.1007/978-3-540-46389-4_2

- Lee, J., Chen, K., Chang, I., & Chen, C. (2022). Determinants of non-performing loans, firm's corporate governance and macroeconomic factors. *International Journal of Finance & Economics*, 27(1), 88–98.
- Lee, J., & Rosenkranz, P. (2020). Nonperforming Loans In Asia: Determinants And Macrofinancial Linkages. In *International Finance Review* (Vol. 21, pp. 33–53). Emerald Group Holdings Ltd. <https://doi.org/10.1108/S1569-376720200000021003>
- Louzis, D. P., Vouldis, A. T., & Metaxas, V. L. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of banking & finance*, 36(4), 1012-1027. doi: 10.2139/ssrn.1703026
- Mahadeva, L., & Robinson, P. (2004). Unit root testing to help model building. Centre for Central Banking Studies, Bank of England London.
- Mahyoub, M., & Said, R. M. (2021). Factors influencing non-performing loans: Empirical evidence from commercial banks in Malaysia. *Research Journal of Business and Management*, 8(3), 160-166.
- Makri, V., Tsagkanos, A., & Bellas, A. (2014). Determinants of non-performing loans: The case of Eurozone. *Panoeconomicus*, 61(2), 193–206. <https://doi.org/10.2298/PAN1402193M>.
- Malaysian Department of Insolvency. (2022). Bankruptcy statistics 2022. <https://www.mdi.gov.my/index.php/legislation/statistics/75-bankruptcy/1983-bankruptcy-statistic-2022>
- Marouf, F. Z., & Guellil, Z. (2017). The macroeconomic determinants of credit risk: The Algerian Banking System. In *Management International Conference*, Italy.
- Maybank Berhad. (2015). Annual report 2015. Maybank Berhad.
- Mazreku, I., Morina, F., Misiri, V., Spiteri, J. v, & Grima, S. (2018). Determinants of the Level of Non-Performing Loans in Commercial Banks of Transition Countries. In *European Research Studies Journal*: Vol. XXI (Issue 3).
- Mensah, F. A., & Adjei, A. B. (2015). Determinants of non-performing loans in Ghana banking industry. *International Journal of Computational Economics and Econometrics*, 5(1), 35–54.
- Messai, A. S., & Gallali, M. I. (2019). Macroeconomic determinants of credit risk: A P-VAR approach evidence from Europe. *International Journal of Monetary Economics and Finance*, 12(1), 15-24.

- Messai, A. S., & Jouini, F. (2013). Micro and Macro Determinants of Non-performing Loans. *International Journal of Economics and Financial Issues*, 3(4), 852–860.
- Mileris, R. (2014). Macroeconomic factors of non-performing loans in commercial banks. *Ekonomika*, 93(1), 22-39.
- Morden, Z. (2022, June 23). Insolvency Dept data shows 60% bankrupts between age 25–44, personal loan is top reason. *Malay Mail*.
- Mohamed, S., Abd Hamid, M. A., Hosin, H., & Md Isa, M. A. (2021). Non-performing Loans Issues in Malaysian Banking Industry. *International Journal of Academic Research in Business and Social Sciences*, 11(3). doi: 10.6007/ijarbss/v11-i3/8784
- Montes-Rojas, G., & Sosa-Escudero, W. (2011). Robust tests for heteroskedasticity in the one-way error components model. *Journal of Econometrics*, 160(2), 300–310.
- Muhamad Yusuf, N. H., Mohamad Shamsudin, M. S., Mohd Abdoh, W. M. Y., Badri Shah, N. S., & Shekh Zain, R. (2021). Determinants of credit risk: Evidence from commercial banks in Malaysia. *Jurnal Intelek*, 16(1), 134-143.
- Mustafa, S. A., & Ali, M. (2019). Macroeconomic Factors Influence on Non-Performing Loans: The Case of Commercial Banks in Malaysia. *International Transaction Journal of Engineering*, 10(17). doi: 10.14456/Itjemast.2019.234
- Naili, M., & Lahrichi, Y. (2022). Banks' credit risk, systematic determinants and specific factors: recent evidence from emerging markets. *Heliyon*, 8(2). doi: 10.1016/j.heliyon. 2022.e08960
- Nargis, N., Ahmad, N., Ibrahim, N., & Kefeli, Z. (2019). Link between non-performing loans (NPL) and economic growth-evidence from an emerging economy. In *The Business and Management Review* (Vol. 10).
- Osunkoya, M., Ikpefan, O., & Olokoyo, F. (2023). Macroeconomic and Bank-Specific Determinants of Non-Performing Loans in Nigeria. *WSEAS Transactions on Business and Economics*, 20. doi: 10.37394/23207.2023.20.103
- Ozili, P. K. (2019). Non-performing loans and financial development: new evidence. *Journal of Risk Finance*, 20(1). <https://doi.org/10.1108/JRF-07-2017-0112>
- Park, H. M. (2011). Practical guides to panel data modeling: a step-by-step analysis using stata. Public Management and Policy Analysis Program, Graduate School of International Relations, International University of Japan, 12, 1–52.

- Pandey, B. (2024). Analysing the impact of macroeconomic variables on non-performing loans in Nepalese banks. *Butwal Campus Journal*, 7(2), 102–114. doi: 10.3126/bcj.v7i2.73187
- Petkovski, M., Kjosevski, J., & Jovanovski, K. (2021). Macro And Bank Specific Determinants of Non-Performing Loans in Polish Commercial Banks. *Argumenta Oeconomica*, 2, 107–126. <https://doi.org/10.15611/AOE.2021.2.06>
- Pratap, S., & Urrutia, C. (2004). Firm dynamics, investment and debt portfolio: balance sheet effects of the Mexican crisis of 1994. *Journal of Development Economics*, 75(2), 535–563.
- Radivojevic, N., & Jovovic, J. (2017). Examining of determinants of non-performing loans. *Prague Economic Papers*, 26(3), 300–316. <https://doi.org/10.18267/j.pep.615>.
- Rajan, R. G., & Zingales, L. (1998). Financial Dependence and Growth. *American Economic Review*, 88(3).
- Saba, I., Kouser, R., & Azeem, M. (2012). Determinants of non performing loans: Case of US banking sector. *The Romanian Economic Journal*, 44(6), 125-136.
- Shrestha, N. (2020). Detecting Multicollinearity in Regression Analysis. *American Journal of Applied Mathematics and Statistics*, 8(2).
- Singgih, M. L., Syairudin, B., & Suhariyanto, T. T. (2014). Designing Citizen Business Loan Model to Reduce Non-Performing Loan: An Agent-based Modeling and Simulation Approach in Regional Development. *APMBA (Asia Pacific Management and Business Application)*, 2(3), 144-153. doi: 10.21776/ub.apmba.2014.002.03.1
- Singh, P. S. K. (2022). Analysis on Malaysian Non-Performing Loans and Financing Sale, Effects of Covid-19 and its Legal and Regulatory Framework. *International Journal of Advanced Research in Economics and Finance*, 4(2), 1–11.
- Singh, S. K., Basuki, B., & Setiawan, R. (2021). The Effect of Non-Performing Loan on Profitability: Empirical Evidence from Nepalese Commercial Banks. *Journal of Asian Finance, Economics and Business*, 8(4), 709–716. <https://doi.org/10.13106/jafeb.2021.vol8.no4.0709>
- Sing, R. D. R., Hosin, H., Mohamad, S., & Bawazir, A. A. (2024). Assessing the severity of non-performing loans for residential and non-residential properties

- in Malaysia. *Journal of Asian Scientific Research*, 14(4), 659–671. <https://doi.org/10.55493/5003.v14i4.5224>
- Sirpal, R. (2009). Methods of payment and foreign-exchange risk management among firms in Brunei Darussalam. *The Journal of Risk Finance*, 10(4), 377–392.
- Skarica, B. (2014). Determinants of non-performing loans in Central and Eastern European countries. *Financial Theory and Practice*, 38(1), 37–59. doi: 10.3326/fintp.38.1.2
- Stasinopoulos, S.-G. (2015). How compensation plans affect people's Life Cycle theory of Consumption and Saving.
- Sun, M. L., & Purwanto. (2021). Determinant Factors of Non-Performing Loans in Chinese Commercial Banks. 08(02).
- The Star. (2025, March 13). Over 5,000 youths declared bankrupt since 2020, mostly due to personal loans.
- Vaicondam, Y., Hishan, S. S., & Shan, T. P. (2019). The study on factors that influencing banks' non-performing loans in Malaysia. *International Journal of Engineering and Advanced Technology*, 8(5), 1289-1297. doi: 10.35940/ijeat.E1183.0585C19
- Vogler, S., Schneider, P., & Zimmermann, N. (2019). Evolution of Average European Medicine Prices: Implications for the Methodology of External Price Referencing. *PharmacoEconomics - Open*, 3(3), 303–309.
- Wairimu, M. M., & Gitundu, E. W. (2017). Macroeconomic Determinants of Non-Performing Loans in Kenya: 1998-2015. *Research Journal of Finance and Accounting* www.iiste. Org ISSN, 8(4), 97–105.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.
- Xiao, J. J., & Yao, R. (2014). Consumer debt delinquency by family lifecycle categories. *International Journal of Bank Marketing*, 32(1), 43–59.
- Yusuf, N. H. M., Shamsudin, M. S. M., Abdoh, W. M. Y. M., Shah, N. S. B., & Zain, R. S. (2021). Determinants of Credit Risk: Evidence from Commercial Banks in Malaysia. *Jurnal Intelek*, 16(1), 134–143. doi: 10.24191/ji.v16i1.373
- Zain, E. N. M., Ghazali, P. L., & Daud, W. M. W. (2020). Determinants Of Non-Performing Loans: Evidence from Conventional Banks in Malaysia. *Humanities & Social Sciences Reviews*, 8(2), 423–430. doi: 10.18510/hssr.2020.8248

- Zainol, J. M., Nor, A. M., Ibrahim, S. N., & Daud, S. (2018). Macroeconomics determinants of non-performing loans in Malaysia: An ARDL approach. *International Journal of Academic Research in Business and Social Sciences*, 8(10), 692-706. doi: 10.6007/IJARBSS/v8-i10/4773
- Zulkifli, N. E., & Zuriyati, A. (2022a). Determinants of Non-Performing Loans Amidst Unexpected Crises in Malaysia's Commercial Banks. 7(39), 183–193. <https://doi.org/10.55573/IJAFB.073917>
- Zulkifli, N. E., & Ahmad, Z. (2022b). Nonperforming Loans in Malaysia's Commercial Banks: Analysis of Trend and Issues. *International Journal of Academic Research in Accounting Finance and Management Sciences*. 12(2), 483 – 494. doi: 10.6007/IJARAFMS /v12-i2/12930

APPENDICES

APPENDIX 1

Results of Static Panel Model From STATA



User: STATA

```

1 . clear

2 . *(12 variables, 374 observations pasted into data editor)

3 . destring, replace
   code already numeric; no replace
   year already numeric; no replace
   bank: contains nonnumeric characters; no replace
   bankcode: contains nonnumeric characters; no replace
   npls already numeric; no replace
   unemp already numeric; no replace
   gdpgr already numeric; no replace
   infl already numeric; no replace
   lir already numeric; no replace
   lnexc already numeric; no replace
   gfc already numeric; no replace
   pdc already numeric; no replace

4 . xtset code year

   Panel variable: code (strongly balanced)
   Time variable: year, 2002 to 2023
   Delta: 1 unit

5 . xtsum npls unemp gdpgr infl lir lnexc gfc pdc

```

Variable		Mean	Std. dev.	Min	Max	Observations	
npls	overall	4.184337	5.424159	0	54.2263	N =	374
	between		1.984383	1.205527	7.873368	n =	17
	within		5.070051	-3.342977	50.88192	T =	22
unemp	overall	3.469318	.4209209	2.875	4.65	N =	374
	between		0	3.469318	3.469318	n =	17
	within		.4209209	2.875	4.65	T =	22
gdpgr	overall	4.648891	2.89317	-5.4568	8.8618	N =	374
	between		0	4.648891	4.648891	n =	17
	within		2.89317	-5.4568	8.8618	T =	22
infl	overall	2.158341	1.346141	-1.1387	5.4408	N =	374
	between		0	2.158341	2.158341	n =	17
	within		1.346141	-1.1387	5.4408	T =	22
lir	overall	5.133991	.8739485	3.4441	6.5283	N =	374
	between		0	5.133991	5.133991	n =	17
	within		.8739485	3.4441	6.5283	T =	22
lnexc	overall	4.526323	.0744812	4.3827	4.6393	N =	374
	between		0	4.526323	4.526323	n =	17
	within		.0744812	4.3827	4.6393	T =	22
gfc	overall	.0909091	.2878649	0	1	N =	374
	between		0	.0909091	.0909091	n =	17
	within		.2878649	0	1	T =	22
pdc	overall	.1363636	.343634	0	1	N =	374
	between		0	.1363636	.1363636	n =	17
	within		.343634	0	1	T =	22

6 . summarize npls unemp gdp g infl lir lnexc gfc pdc

Variable	Obs	Mean	Std. dev.	Min	Max
npls	374	4.184337	5.424159	0	54.2263
unemp	374	3.469318	.4209209	2.875	4.65
gdp g	374	4.648891	2.89317	-5.4568	8.8618
infl	374	2.158341	1.346141	-1.1387	5.4408
lir	374	5.133991	.8739485	3.4441	6.5283
lnexc	374	4.526323	.0744812	4.3827	4.6393
gfc	374	.0909091	.2878649	0	1
pdc	374	.1363636	.343634	0	1

7 . summarize npls unemp gdp g infl lir lnexc gfc pdc, detail

NPLs					
Percentiles	Smallest				
1%	.0064	0			
5%	.1489	0			
10%	.5341	.0014	Obs	374	
25%	1.5725	.0064	Sum of wgt.	374	
50%	2.4395		Mean	4.184337	
		Largest	Std. dev.	5.424159	
75%	4.2575	27.8025			
90%	10.7446	31.0792	Variance	29.4215	
95%	14.582	32.5127	Skewness	3.942901	
99%	27.8025	54.2263	Kurtosis	26.8037	
UNEMP					
Percentiles	Smallest				
1%	2.875	2.875			
5%	3.025	2.875			
10%	3.05	2.875	Obs	374	
25%	3.225	2.875	Sum of wgt.	374	
50%	3.375		Mean	3.469318	
		Largest	Std. dev.	.4209209	
75%	3.6	4.65			
90%	3.825	4.65	Variance	.1771744	
95%	4.525	4.65	Skewness	1.464392	
99%	4.65	4.65	Kurtosis	5.000399	
GDPG					
Percentiles	Smallest				
1%	-5.4568	-5.4568			
5%	-1.5135	-5.4568			
10%	3.3153	-5.4568	Obs	374	
25%	4.4498	-5.4568	Sum of wgt.	374	
50%	5.313		Mean	4.648891	
		Largest	Std. dev.	2.89317	
75%	5.8127	8.8618			
90%	6.7834	8.8618	Variance	8.370433	
95%	7.4248	8.8618	Skewness	-2.169726	
99%	8.8618	8.8618	Kurtosis	8.014496	

INFL					
	Percentiles	Smallest			
1%	-1.1387	-1.1387			
5%	.5833	-1.1387			
10%	.6629	-1.1387	Obs		374
25%	1.4213	-1.1387	Sum of wgt.		374
50%	2.0975		Mean		2.158341
		Largest	Std. dev.		1.346141
75%	3.143	5.4408			
90%	3.6092	5.4408	Variance		1.812096
95%	3.8712	5.4408	Skewness		.0146264
99%	5.4408	5.4408	Kurtosis		3.723194
LIR					
	Percentiles	Smallest			
1%	3.4441	3.4441			
5%	3.908	3.4441			
10%	3.9442	3.4441	Obs		374
25%	4.587	3.4441	Sum of wgt.		374
50%	4.9217		Mean		5.133991
		Largest	Std. dev.		.8739485
75%	6.0458	6.5283			
90%	6.4092	6.5283	Variance		.763786
95%	6.4858	6.5283	Skewness		.1191709
99%	6.5283	6.5283	Kurtosis		2.072626
LnExc					
	Percentiles	Smallest			
1%	4.3827	4.3827			
5%	4.4079	4.3827			
10%	4.4222	4.3827	Obs		374
25%	4.4608	4.3827	Sum of wgt.		374
50%	4.54545		Mean		4.526323
		Largest	Std. dev.		.0744812
75%	4.5858	4.6393			
90%	4.6034	4.6393	Variance		.0055475
95%	4.6052	4.6393	Skewness		-.3989667
99%	4.6393	4.6393	Kurtosis		1.815829
GFC					
	Percentiles	Smallest			
1%	0	0			
5%	0	0			
10%	0	0	Obs		374
25%	0	0	Sum of wgt.		374
50%	0		Mean		.0909091
		Largest	Std. dev.		.2878649
75%	0	1			
90%	0	1	Variance		.0828662
95%	1	1	Skewness		2.84605
99%	1	1	Kurtosis		9.1

PDC					
Percentiles			Smallest		
1%	0	0	0		
5%	0	0	0		
10%	0	0	0	Obs	374
25%	0	0	0	Sum of wgt.	374
50%	0			Mean	.1363636
			Largest	Std. dev.	.343634
75%	0	1	1		
90%	1	1	1	Variance	.1180843
95%	1	1	1	Skewness	2.119252
99%	1	1	1	Kurtosis	5.491228

8 . xtunitroot llc npls

Levin-Lin-Chu unit-root test for npls

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N/T ->	0
Panel means: Included		
Time trend: Not included		

ADF regressions: 1 lag
LR variance: Bartlett kernel, 8.00 lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-19.7581	
Adjusted t*	-15.8040	0.0000

9 . xtunitroot breitung npls

Breitung unit-root test for npls

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: T,N ->	Infinity
Panel means: Included		sequentially
Time trend: Not included	Prewhitening: Not	performed

	Statistic	p-value
lambda	3.0331	0.9988

10 . xtunitroot ht npls

Harris-Tzavalis unit-root test for npls

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N ->	Infinity
Panel means: Included		T Fixed
Time trend: Not included		

	Statistic	z	p-value
rho	0.5864	-8.6239	0.0000


```
15 . xtunitroot llc unemp
```

Levin-Lin-Chu unit-root test for unemp

H_0 : Panels contain unit roots
 H_a : Panels are stationary

Number of panels = 17
Number of periods = 22

AR parameter: Common
Panel means: Included
Time trend: Not included

Asymptotics: $N/T \rightarrow 0$

ADF regressions: 1 lag

LR variance: **Bartlett** kernel, **8.00** lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-11.1624	
Adjusted t*	-5.7262	0.0000

16 . xtunitroot breitung unemp

Breitung unit-root test for unemp

H_0 : Panels contain unit roots
 H_a : Panels are stationary

Number of panels = 17
Number of periods = 22

AR parameter: Common
Panel means: Included
Time trend: Not included

Asymptotics: $T, N \rightarrow \text{Infinity}$
sequentially
Prewhitening: Not performed

	Statistic	p-value
lambda	-7.9908	0.0000

```
17 . xtunitroot ht unemp
```

Harris-Tzavalis unit-root test for unemp

H_0 : Panels contain unit roots
 H_a : Panels are stationary

Number of panels = 17
Number of periods = 22

AR parameter: Common
Panel means: Included
Time trend: Not included

Asymptotics: $N \rightarrow \text{Infinity}$
T Fixed

	Statistic	z	p-value
rho	0.6217	-7.5501	0.0000

```
18 . gen dunemp=d.unemp
    (17 missing values generated)
```

19 . xtunitroot llc dunemp

Levin-Lin-Chu unit-root test for **dunemp**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
Time trend: Not included		

ADF regressions: **1** lag
 LR variance: **Bartlett** kernel, **8.00** lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-23.0691	
Adjusted t*	-16.2840	0.0000

20 . xtunitroot breitung dunemp

Breitung unit-root test for **dunemp**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: T,N -> Infinity	
Panel means: Included	sequentially	
Time trend: Not included	Prewhitening: Not performed	

	Statistic	p-value
lambda	-11.6837	0.0000

21 . xtunitroot ht dunemp

Harris-Tzavalis unit-root test for **dunemp**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

	Statistic	z	p-value
rho	0.0576	-23.5088	0.0000

22 . xtunitroot llc gdp

Levin-Lin-Chu unit-root test for **gdp**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
Time trend: Not included		

ADF regressions: 1 lag
 LR variance: **Bartlett** kernel, **8.00** lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-17.3621	
Adjusted t*	-11.5185	0.0000

23 . xtunitroot breitung gdp

Breitung unit-root test for **gdp**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: T,N -> Infinity	
Panel means: Included	sequentially	
Time trend: Not included	Prewhitening: Not performed	

	Statistic	p-value
lambda	-12.6784	0.0000

24 . xtunitroot ht gdp

Harris-Tzavalis unit-root test for **gdp**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

	Statistic	z	p-value
rho	-0.0135	-26.8932	0.0000

25 . gen dgdpg=d.gdp (17 missing values generated)

26 . xtunitroot llc dgdpg

Levin-Lin-Chu unit-root test for **dgdpg**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
Time trend: Not included		

ADF regressions: 1 lag
 LR variance: **Bartlett** kernel, **8.00** lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-24.9500	
Adjusted t*	-16.8218	0.0000

27 . xtunitroot breitung dgdpg

Breitung unit-root test for **dgdpg**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: T,N -> Infinity	
Panel means: Included	sequentially	
Time trend: Not included	Prewhitening: Not performed	

	Statistic	p-value
lambda	-14.7243	0.0000

28 . xtunitroot ht dgdpg

Harris-Tzavalis unit-root test for **dgdpg**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

	Statistic	z	p-value
rho	-0.3961	-36.7408	0.0000

29 . xtunitroot llc infl

Levin-Lin-Chu unit-root test for **infl**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
Time trend: Not included		

ADF regressions: **1 lag**

LR variance: **Bartlett** kernel, **8.00** lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-14.3163	
Adjusted t*	-8.5352	0.0000

30 . xtunitroot breitung infl

Breitung unit-root test for **infl**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22

	Statistic	p-value
lambda	-12.6008	0.0000

Harris-Tzavalis unit-root test for infl

AR parameter: Common Asymptotics: N -> Infinity
Panel means: Included T Fixed
Time trend: Not included

	Statistic	z	p-value
rho	-0.0010	-26.5130	0.0000

```
33 . xtunitroot llc dinfl
```

Levin-Lin-Chu unit-root test for dinfl

AR parameter: **Common** Asymptotics: **N/T -> 0**
Panel means: **Included**
Time trend: **Not included**

	Statistic	p-value
Unadjusted t	-21.7900	
Adjusted t*	-14.4327	0.0000

Breitung unit-root test for dinfl

AR parameter:	Common	Asymptotics:	T,N -> Infinity
Panel means:	Included		sequentially
Time trend:	Not included	Prewhitening:	Not performed

	Statistic	p-value
lambda	-14.3236	0.0000

35 . xtunitroot ht dinfl

Harris-Tzavalis unit-root test for **dinfl**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	21
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

	Statistic	z	p-value
rho	-0.4744	-39.0225	0.0000

36 . xtunitroot llc lir

Levin-Lin-Chu unit-root test for **lir**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
Time trend: Not included		

ADF regressions: **1 lag**

LR variance: **Bartlett kernel, 8.00 lags average (chosen by LLC)**

	Statistic	p-value
Unadjusted t	-10.0609	
Adjusted t*	-5.9460	0.0000

37 . xtunitroot breitung lir

Breitung unit-root test for **lir**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: T,N -> Infinity	
Panel means: Included	sequentially	
Time trend: Not included	Prewhitening: Not performed	

	Statistic	p-value
lambda	-1.9134	0.0278

38 . xtunitroot ht lir

Harris-Tzavalis unit-root test for **lir**

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22

	Statistic	z	p-value
rho	0.7926	-2.3427	0.0096

	Statistic	p-value
Unadjusted t	-15.3139	
Adjusted t*	-2.4135	0.0079

	Statistic	p-value
lambda	-5.7607	0.0000

	Statistic	z	p-value
rho	0.4815	-11.1458	0.0000

43 . xtunitroot llc lnexc

Levin-Lin-Chu unit-root test for lnexc

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N/T ->	0
Panel means: Included		
Time trend: Not included		

ADF regressions: 1 lag

LR variance: Bartlett kernel, 8.00 lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-1.9597	
Adjusted t*	2.3455	0.9905

44 . xtunitroot breitung lnexc

Breitung unit-root test for lnexc

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: T,N ->	Infinity
Panel means: Included		sequentially
Time trend: Not included	Prewhitening: Not	performed

	Statistic	p-value
lambda	4.3076	1.0000

45 . xtunitroot ht lnexc

Harris-Tzavalis unit-root test for lnexc

H0: Panels contain unit roots	Number of panels =	17
Ha: Panels are stationary	Number of periods =	22
AR parameter: Common	Asymptotics: N ->	Infinity
Panel means: Included		T Fixed
Time trend: Not included		

	Statistic	z	p-value
rho	0.9373	2.0644	0.9805

46 . gen dlnexc=d.lnexc
(17 missing values generated)

47 . xtunitroot llc dlnexc

Levin-Lin-Chu unit-root test for dlnexc

H0: Panels contain unit roots Number of panels = 17
 Ha: Panels are stationary Number of periods = 21

AR parameter: Common Asymptotics: N/T -> 0
 Panel means: Included
 Time trend: Not included

ADF regressions: 1 lag
 LR variance: Bartlett kernel, 8.00 lags average (chosen by LLC)

	Statistic	p-value
Unadjusted t	-15.5507	
Adjusted t*	-7.9813	0.0000

48 . xtunitroot breitung dlnexc

Breitung unit-root test for dlnexc

H0: Panels contain unit roots Number of panels = 17
 Ha: Panels are stationary Number of periods = 21

AR parameter: Common Asymptotics: T,N -> Infinity
 Panel means: Included sequentially
 Time trend: Not included Prewhitening: Not performed

	Statistic	p-value
lambda	-6.3179	0.0000

49 . xtunitroot ht dlnexc

Harris-Tzavalis unit-root test for dlnexc

H0: Panels contain unit roots Number of panels = 17
 Ha: Panels are stationary Number of periods = 21

AR parameter: Common Asymptotics: N -> Infinity
 Panel means: Included T Fixed
 Time trend: Not included

	Statistic	z	p-value
rho	0.2037	-19.2480	0.0000

50 . correlate npls unemp gdpd infl lir dlnexc gfc pdc
 (obs=357)

	npls	unemp	gdpd	infl	lir	dlnexc	gfc	pdc
npls	1.0000							
unemp	0.0582	1.0000						
gdpd	0.1013	-0.5425	1.0000					
infl	-0.0713	-0.3215	0.5763	1.0000				
lir	0.4301	-0.3901	0.2747	0.2080	1.0000			
dlnexc	-0.0729	-0.2125	0.2575	0.1900	0.1734	1.0000		
gfc	0.0449	-0.1463	0.1046	0.3682	0.4561	0.2054	1.0000	
pdc	-0.1087	0.8201	-0.3282	-0.1791	-0.6349	-0.1166	-0.1325	1.0000

51 . reg npls unemp gdp g infl lir dlncxc gfc pdc

Source	SS	df	MS	Number of obs	=	357
Model	2019.2192	7	288.459886	F(7, 349)	=	23.73
Residual	4242.96039	349	12.1574796	Prob > F	=	0.0000
				R-squared	=	0.3224
				Adj R-squared	=	0.3089
Total	6262.17959	356	17.5903921	Root MSE	=	3.4868

npls	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
unemp	2.209326	.9969426	2.22	0.027	.2485549	4.170098
gdp g	.3281124	.0950372	3.45	0.001	.1411947	.5150301
infl	-.5146396	.179267	-2.87	0.004	-.8672192	-.16206
lir	3.334044	.3758423	8.87	0.000	2.594843	4.073245
dlncxc	-16.20523	6.232526	-2.60	0.010	-28.46326	-3.94719
gfc	-2.058478	.8246674	-2.50	0.013	-3.680422	-.4365354
pdc	1.68504	1.332661	1.26	0.207	-.9360166	4.306097
_cons	-21.53966	3.133602	-6.87	0.000	-27.70278	-15.37654

52 . xtreg npls unemp gdp g infl lir dlncxc gfc pdc, re

Random-effects GLS regression	Number of obs	=	357
Group variable: code	Number of groups	=	17
R-squared:	Obs per group:		
Within = 0.0000	min =		21
Between = 0.0000	avg =		21.0
Overall = 0.3224	max =		21
corr(u_i, X) = 0 (assumed)	Wald chi2(7)	=	199.92
	Prob > chi2	=	0.0000

npls	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
unemp	2.209326	.9086714	2.43	0.015	.428363	3.990289
gdp g	.3281124	.0866224	3.79	0.000	.1583356	.4978892
infl	-.5146396	.1633944	-3.15	0.002	-.8348867	-.1943925
lir	3.334044	.3425645	9.73	0.000	2.66263	4.005458
dlncxc	-16.20523	5.680686	-2.85	0.004	-27.33917	-5.071286
gfc	-2.058478	.7516498	-2.74	0.006	-3.531685	-.585272
pdc	1.68504	1.214665	1.39	0.165	-.6956585	4.065739
_cons	-21.53966	2.878071	-7.48	0.000	-27.18057	-15.89874
sigma_u	1.4619136					
sigma_e	3.1780335					
rho	.17464869	(fraction of variance due to u_i)				

53 . xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

$$npls[code,t] = Xb + u[code] + e[code,t]$$

Estimated results:

	Var	SD = sqrt(Var)
npls	17.59039	4.19409
e	10.0999	3.178034
u	2.137191	1.461914

```
chibar2(01) = 100.40
Prob > chibar2 = 0.0000
```

```
Fixed-effects (within) regression                               Number of obs   =       357
Group variable: code                                           Number of groups  =       17

R-squared:                                                       Obs per group:
    Within = 0.3751                                              min =              21
    Overall = 0.3224                                              avg =             21.0
                                                                max =              21

                                                                F(7, 333)         =      28.56
                                                                Prob > F           =      0.0000
corr(u_i, Xb) = 0.0000
```

npls	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
unemp	2.209326	.9086714	2.43	0.016	.4218665	3.996786
gdpg	.3281124	.0866224	3.79	0.000	.1577162	.4985085
infl	-.5146396	.1633944	-3.15	0.002	-.8360549	-.1932243
lir	3.334044	.3425645	9.73	0.000	2.660181	4.007907
dlnext	-16.20523	5.680686	-2.85	0.005	-27.37978	-5.030672
gfc	-2.058478	.7516498	-2.74	0.007	-3.537059	-.5798981
pdc	1.68504	1.214665	1.39	0.166	-.7043427	4.074424
_cons	-21.53966	2.856147	-7.54	0.000	-27.15802	-15.92129
sigma_u	1.6180664					
sigma_e	3.1780335					
rho	.2058032	(fraction of variance due to u_i)				

F test that all u i=0: F(16, 333) = 5.44 Prob > F = 0.0000

```
56 . xtreg npls unemp gdpg infl lir dlnexc gfc pdc, re
```

Random-effects GLS regression	Number of obs	=	357
Group variable: code	Number of groups	=	17
R-squared:	Obs per group:		
Within = 0.0000	min =		21
Between = 0.0000	avg =		21.0
Overall = 0.3224	max =		21
	Wald chi2(7)	=	199.92
corr(u i, X) = 0 (assumed)	Prob > chi2	=	0.0000

npls	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
unemp	2.209326	.9086714	2.43	0.015	.428363	3.990289
gdpg	.3281124	.0866224	3.79	0.000	.1583356	.4978892
infl	-.5146396	.1633944	-3.15	0.002	-.8348867	-.1943925
lir	3.334044	.3425645	9.73	0.000	2.66263	4.005458
dlnext	-16.20523	5.680686	-2.85	0.004	-27.33917	-5.071286
gfc	-2.058478	.7516498	-2.74	0.006	-3.531685	-.585272
pdc	1.68504	1.214665	1.39	0.165	-.6956585	4.065739
_cons	-21.53966	2.878071	-7.48	0.000	-27.18057	-15.89874
sigma_u	1.4619136					
sigma_e	3.1780335					
rho	.17464869	(fraction of variance due to u_i)				

57 . est store random

58 . hausman fixed random

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
	(b) fixed	(B) random		
unemp	2.209326	2.209326	-2.15e-13	.
gdp	.3281124	.3281124	-1.47e-14	.
infl	-.5146396	-.5146396	7.77e-16	.
lir	3.334044	3.334044	5.33e-14	.
dlncx	-16.20523	-16.20523	2.17e-13	.
gfc	-2.058478	-2.058478	-9.37e-14	.
pd	1.68504	1.68504	2.18e-13	.

b = Consistent under H0 and Ha; obtained from xtreg.
B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

$$\chi^2(7) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.00$$

Prob > chi2 = 1.0000

(V_b-V_B is not positive definite)

59 . reg npls unemp gdp infl lir dlncx gfc pd

Source	SS	df	MS	Number of obs	=	357
Model	2019.2192	7	288.459886	F(7, 349)	=	23.73
Residual	4242.96039	349	12.1574796	Prob > F	=	0.0000
				R-squared	=	0.3224
				Adj R-squared	=	0.3089
Total	6262.17959	356	17.5903921	Root MSE	=	3.4868

npls	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
unemp	2.209326	.9969426	2.22	0.027	.2485549	4.170098
gdp	.3281124	.0950372	3.45	0.001	.1411947	.5150301
infl	-.5146396	.179267	-2.87	0.004	-.8672192	-.16206
lir	3.334044	.3758423	8.87	0.000	2.594843	4.073245
dlncx	-16.20523	6.232526	-2.60	0.010	-28.46326	-3.94719
gfc	-2.058478	.8246674	-2.50	0.013	-3.680422	-.4365354
pd	1.68504	1.332661	1.26	0.207	-.9360166	4.306097
_cons	-21.53966	3.133602	-6.87	0.000	-27.70278	-15.37654

60 . vif

Variable	VIF	1/VIF
pd	6.39	0.156596
unemp	5.40	0.185096
lir	2.91	0.343895
gdp	2.31	0.432480
infl	1.78	0.561514
gfc	1.72	0.581129
dlncx	1.13	0.885898
Mean VIF	3.09	

61 . xtreg npls unemp gdpq infl lir dlnexc gfc pdc, fe

```

Fixed-effects (within) regression               Number of obs   =       357
Group variable: code                           Number of groups =       17

R-squared:                                     Obs per group:
    Within = 0.3751                               min =       21
    Overall = 0.3224                             avg  =      21.0
                                                    max  =       21

corr(u_i, Xb) = 0.0000                        F(7, 333)       =      28.56
                                                    Prob > F        =      0.0000

```

npls	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
unemp	2.209326	.9086714	2.43	0.016	.4218665	3.996786
gdpq	.3281124	.0866224	3.79	0.000	.1577162	.4985085
infl	-.5146396	.1633944	-3.15	0.002	-.8360549	-.1932243
lir	3.334044	.3425645	9.73	0.000	2.660181	4.007907
dlnexc	-16.20523	5.680686	-2.85	0.005	-27.37978	-5.030672
gfc	-2.058478	.7516498	-2.74	0.007	-3.537059	-.5798981
pdc	1.68504	1.214665	1.39	0.166	-.7043427	4.074424
_cons	-21.53966	2.856147	-7.54	0.000	-27.15802	-15.92129
sigma_u	1.6180664					
sigma_e	3.1780335					
rho	.20586032	(fraction of variance due to u_i)				

F test that all u_i=0: F(16, 333) = 5.44 Prob > F = 0.0000

62 . xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: $\sigma(i)^2 = \sigma^2$ for all i

```

chi2 (17) = 4902.96
Prob>chi2 = 0.0000

```

63 . xtserial npls unemp gdpq infl lir dlnexc gfc pdc

Wooldridge test for autocorrelation in panel data

H0: no first order autocorrelation

```

F( 1, 16) = 14.674
Prob > F = 0.0015

```

64 . xtreg npls unemp gdpq infl lir dlnexc gfc pdc, cluster(code)

```

Random-effects GLS regression               Number of obs   =       357
Group variable: code                       Number of groups =       17

R-squared:                                     Obs per group:
    Within = 0.0000                               min =       21
    Between = 0.0000                             avg  =      21.0
    Overall = 0.3224                             max  =       21

corr(u_i, X) = 0 (assumed)                  Wald chi2(7)    =      56.68
                                                    Prob > chi2     =      0.0000

```

(Std. err. adjusted for 17 clusters in code)

npls	Coefficient	Robust std. err.	z	P> z	[95% conf. interval]	
unemp	2.209326	.358468	6.16	0.000	1.506742	2.911911
gdp	.3281124	.052198	6.29	0.000	.2258062	.4304186
infl	-.5146396	.1921555	-2.68	0.007	-.8912575	-.1380217
lir	3.334044	.785324	4.25	0.000	1.794837	4.87325
dlnexc	-16.20523	6.76205	-2.40	0.017	-29.4586	-2.951852
gfc	-2.058478	.5314401	-3.87	0.000	-3.100082	-1.016875
pd	1.68504	.631681	2.67	0.008	.4469684	2.923112
_cons	-21.53966	4.578691	-4.70	0.000	-30.51373	-12.56559
sigma_u	1.4619136					
sigma_e	3.1780335					
rho	.17464869	(fraction of variance due to u_i)				

65 .

AUTHOR'S PROFILE



Elia Ariana Binti Mazlan obtained a diploma in Accounting from University Technology MARA (UiTM) Kota Kinabalu in 2019. In 2022, she received a Bachelor of Business Administration (Honors) in Finance. Upon completing her undergraduate studies, she enrolled at University Technology MARA (UiTM) Kota Kinabalu to pursue a Master of Science in Business and Management. She served as a University Personal Teaching Assistant (UPTA) for two semesters throughout his Master's study. Besides that, she participated in the Grant Kajian Infrastructure Digital Negara as an Enumerator for the Federal Territory of Labuan.

LIST OF PUBLICATION

Mazlan, E.A.B., Mohammed, R.U.B. (2026). The Influence of Macroeconomic Determinants and Unexpected Crises on Non-performing Loans: Evidence from Malaysian Domestic Conventional Banks. In: Mukthar K.P, J., Jain, V., Mansour, N. (eds) Behavioral Economics and Computational Intelligence for Sustainable Decision Making. Studies in Computational Intelligence, vol 1232. Springer, Cham. https://doi.org/10.1007/978-3-032-04174-6_41.