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MACROECONOMIC FACTORS INFLUENCE ON NON-PERFORMING LOANS: THE CASE OF COMMERCIAL BANKS IN MALAYSIA

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ABSTRACT

Given the level of Malaysian economic openness is high, the performance of the financial system especially the banking institutions is ubiquitously exposed to risks of financial stress arising from global financial uncertainty. This headwind, to some greater or lower extent, can be translated into a more challenging prospect of economic growth, price instability, as well as a slower labor market participation faced by the local economy. With greater challenge, it prompts a call towards a continuous assessment on how these uncertainties impact the stability of the banking sector, of which proxied through the performance of non-performing loans (henceforth NPLs). This paper, therefore, aims to examine the macroeconomic influences on NPLs in the case of Malaysian commercial banks. Employing autoregressive distributed lag (ARDL) and bounds testing approach, we explored whether any of these variables namely GDP growth, inflation, and unemployment rate carry informational content about changes of NPLs. Applying this cointegration test onto a dataset of macroeconomic factors and NPLs data of the period spanning from 1998 to 2018 on a quarterly basis, the result suggests that in the long run and short run, GDP growth and unemployment are correlated with the NPLs fluctuations. Inflation, on the other hand, has no correlation. More particularly, GDP growth depicted a negative relationship with NPLs, while the unemployment rate positively influences the NPLs.

1. INTRODUCTION

The unfolding events during the 2008 global financial crisis have brought forward the issues concerning the stability of financial institutions. This includes the vulnerability of financial intermediation especially the banking sector, towards external shocks which in turn resulted in the subsequent increase in the credit risk exposure of banks' loan portfolios. Despite the heterogeneity

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in the level of spread and the severity of repercussions from the crisis across Asian countries, where advanced economies were predominantly affected, emerging economies (including Malaysia), on the other hand, has remained relatively unscathed. However, the development in the international financial system such as to combat the crisis will continue to pose challenges to Asia. This includes, both in maintaining the soundness of the financial system as well as the stability of macroeconomic fundamentals.

Given the level of Malaysian economic openness is high, the performance of the financial system especially the banking institutions is ubiquitously exposed to risks of financial stress arising from global financial uncertainty. The headwind happening in the global environment, to some greater or lesser extent, might be translated into a more challenging prospect of economic growth, price instability, as well as slower labor market participation faced by the local economy. With the greater challenge, it prompts a call towards a continuous assessment of how these uncertainties affect the stability of the banking sector.

In Malaysia, the banking institutions remain the primary form of financial intermediation and as such is the largest channel for the mobilization of domestic savings. Malaysian financial system is dominated by the banking sector, particularly commercial banks which provided the highest proportion of total loans (approximately 69 percent) compared to other segments of financial institutions. Understanding the soundness of commercial banking industries is therefore important to ensure the financial stability in Malaysia.

2. LITERATURE REVIEW

2.1 NON-PERFORMING LOANS

The use of NPLs to measure credit risk is common because it reflects the economic-wide default propensity of the banking sector's overall loan exposure. (Pesaran and Shin 1998, Ivanović (2016)) claimed that NPLs can give the signal of a banking crisis because it may unfavorably impact economic growth by decreasing credit development. High-level NPLs indicate a vulnerable banking system as it reduces banks' profitability and growth, while a low-level NPLs reflects a stable financial system. In particular, the problem loans discourage interest earnings, deteriorates investment opportunities and can create liquidity crunch in a financial system, which then can bring bankruptcy problem. Therefore, identifying the factors driving NPLs fluctuations is indeed crucial.

NPLs refer to loans that remain unpaid when it past due. According to the International Monetary Fund, a loan that does not generate interest and principal for a minimum of 90 days is considered as non-performing. The level of NPLs is attributable to many factors. This includes both bank-specific factors such as poor credit policy, lack of regular monitoring of obligors, unskilled credit approvers, and high interest spreads to cause high NPLs (Koju et al. 2018). Similarly, economic recession, high jobless rate, and high inflationary pressure are the major macroeconomic conditions that cause problem loans to increase and, consequently, leads to an unstable financial system in the overall economy.

2.2 RELATIONSHIP BETWEEN MACROECONOMIC FACTORS AND NPLS

Demirgüç-Kunt (1989) and Barr and Siems (1994) were among early studies that linked banks' failure with asset quality as an indicator of insolvency. Since then, studies exploring the

determinants of banks' asset quality at country-specific levels as well as across countries, in particular to NPLs, have intensified. This interest was driven primarily because it was particularly crucial for policymakers concerned with financial stability and for banks' management (Louzis et al. 2012). The results were substantially important in providing valuable insights not only about the fragility of banks and the quality of loan portfolios in general but also in knowing the main causes that have a higher tendency to impact the level of NPLs, in particular.

The categorization of NPL determinants as documented in the literature can be largely divided into three; first is related to bank-specific factors such as studied by Manab et al. (2015), Ahmad and Bashir (2013), and Fries and Taci (2005). Second are factors related to macroeconomic events. Recent study examples are Szarowska (2018), Mpofu and Nikolaidou (2018), Beck, Jakubik et al. (2013), Akinlo and Emmanuel (2014), and Castro (2013). Third, studies that combined both bank-specific and macroeconomic variables such as Koju et al. (2018), Vouldis and Louzis (2018), Kumar et al. (2018), Ghosh (2015), Zaib et al. (2014), Abid et al. (2014), Makri et al. (2014), and Louzis et al. (2012). This paper, our review of previous studies will focus on the second category.

Szarowska (2018) described the effect of macroeconomic determinants on problem loans in Central and Eastern European countries using panel regression. The study used annual data of economic growth, jobless rate, inflation, interest rate and currency rate to represent macro variables spanning from 1999 to 2015. They found a negative influence of inflation, GDP and exchange rate on NPLs and the positive influence of the unemployment rate and the lending interest rate on NPLs. Mpofu and Nikolaidou (2018) studied the macroeconomic determinants of credit risk in the banking system of 22 Sub Saharan economies using dynamic panel data approach. The study revealed that an unfavorable economic condition leads to increasing credit exposure in the banking sector in Sub Saharan Africa. In particular, GDP has a negative relationship with NPLs, while inflation rate, trade openness, domestic credit to private sector and global volatility all have positive influence on NPLs. Beck, Jakubik et al. (2013) examined the empirical determinants of NPL ratios using a novel set data of 75 countries, and found that a decline in real gross domestic product (GDP), currency depreciation, and a decrease in stock price will negatively affect the banks' asset quality. Substantial lending in foreign currencies as well as dominant role of stock market plays relative to domestic economy, were stated to be the main sources of NPLs' vulnerability. Using Nigeria as a sample, Akinlo and Emmanuel (2014) developed a macroeconomic model of NPLs using the co-integration analysis. The findings showed that the economic growth and the stock market index have a negative effect on NPLs, whereas the unemployment rate, the credit to private sectors, and the exchange rate influenced NPLs positively.

The above studies emphasize that tagging the main macroeconomic variables; in particular the GDP growth, inflation, and unemployment rate, into measuring the level of NPLs is feasible at this juncture.

3. DATA AND METHODOLOGY

3.1 DEFINITION OF VARIABLES

Based on the commonly used economic variables in the previous literature, we use the quarterly change of GDP growth, inflation, and the unemployment rate to serve as proxies to reflect

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economic conditions, considering their roles as broad (or general) aggregates that ascertain the behavior of an economy at large. Below subsections brief the details of the variables we used in this study:

(a) Non-Performing Loans – In general, NPLs refer to unpaid loans that passed due to its maturity date, and such loans are no longer anticipated to be received in the future. In credit risk management, NPLs are considered as a common proxy to gauge credit risk as directly impacts the banking institutions at an aggregate level, Koju, Koju et al. (2018) and also signal future losses for the banks (Reinhart and Rogoff 2010, Vouldis and Louzis 2018).

(b) Gross domestic product (GDP) – GDP measures the total value of national's output, whereby it's a common variable to reflect economic strength. When GDP growth deteriorates during the contraction period, the probability that more borrowers will default might be relatively high because slower GDP growth often been accompanied by lower earnings expectations hence low ability to generate cash flows to serve their debt obligations. In contrast, fewer defaults are expected during expansionary times.

(c) Consumer price index (CPI) – Inflation gauges the general increase in the level of price of goods and services. For a corporation, high inflationary pressures result in higher production costs, thus affecting cash flow positively. Due to this tendency of having better cash flows, borrowers' debt burden will be reduced and subsequently, it might be argued that the increase in inflation leads to a decreasing in asset quality and vice versa. However, the effect can counter at times when a corporation cannot transfer the increasing price environment to the final consumers resulting in lower cash flows received.

(d) Unemployment rate – Unemployment refers to those people who don't have a job but interested to work (Department of Statistics). A higher unemployment rate depicts the inability of corporations to hire due to cutting the cost of operations. As a result, production decreases and so does the profit, leaving it tougher for corporation to pay their debt obligations. Thus, a positive relationship between the unemployment rate and banks' asset quality is expected.

All historical data related to macroeconomic factors are sourced from *BNM* Monthly Highlights and Statistics, as well as the Department of Statistics, various issues. The data are quarterly data covering the period from 2008 to 2018.

Table 1: Descriptive statistics.

Variables	NPL	GDP	CPI	UNEMPLOYMENT
Mean	36401.95	178800.20	108.44	3.34
Median	35816.39	164131.99	106.90	3.30
Maximum	55001.00	356009.00	120.90	4.50
Minimum	21818.93	68502.00	99.40	2.70
Std. Dev	11429.55	83267.96	6.03	0.33
Skewness	0.03	0.39	0.42	0.81
Kurtosis	1.36	1.89	2.04	3.77
Jarque-Bera	9.03	6.08	5.42	10.78
Probability	0.01***	0.05**	0.07*	0.00***
Sum	2912155.75	14304015.73	8675.10	266.81
Sum Sq. Dev.	10320141325.56	547750683274.64	2870.41	8.39
Observations	80	80	80	80

Note: *, **, ***, **** statistical significance at 1%, 2.5%, 5% and 10% respectively. All variables are tested using raw data.

3.2 ECONOMETRIC MODEL

The functional form of the baseline model is as follows:

$$Y_t = B_0 + B_{11}\mathrm{NPL}_{t-i} + b_{21}lngdp_{t-i} + b_{31}lncpi_{t-i} + b_{41}lnunemployment_{t-i} + e_{1t} \quad (1)$$

Table 1, the descriptive statistics show that all data are normally distributed and platykurtic, except unemployment which is moderately skewed (positive) and leptokurtic.

3.3 ESTIMATION PROCEDURE

3.3.1 ARDL BOUND TESTING APPROACH

Due to the flaws of the commonly used approach, namely the Engle-Granger and Johansen Juselius, Pesaran (1998) developed the newly cointegration method, called auto-regressive distributed lag. The application of EG and JJ requires unit tests as a prerequisite, otherwise, cointegration analysis cannot proceed. This prerequisite introduces a degree of uncertainty into the analysis of levels relationship. Besides, the EG technique is less feasible to be employed in a multivariate model because it is based on the assumption that there is only one cointegrating vector that connects all the variables (Pesaran et al. 2001). Due to these weaknesses, the ARDL test is considered as more suitable, because it can be applied despite the stationary properties of the variables, that is even the variables used are I(0), I(1) or mutually cointegrated. In addition, this technique provides robust results for a smaller size of cointegration analysis. The ARDL model also able to capture appropriate number of lags for data generating process in a general to specific modeling framework (Laurenceson and Chai 2003; Kassim 2016).

All data used in this study are expressed in natural logarithm form

$$\begin{aligned}\Delta\ln\mathrm{NPL}_t = {} & \alpha_0 + \lambda_1\mathrm{GDP}_{t-1} + \lambda_2\ln\mathrm{CPI}_{t-1} + \lambda_3\text{in unemployment}_{t-1} + \lambda_4\ln\mathrm{NPL}_{t-1} + \\ & \sum_{i=1}^{p}\beta_1\,\Delta\mathrm{GDP}_{t-i} + \sum_{i=0}^{p}\beta_2\Delta\ln\mathrm{CPI}_{t-i} + \sum_{i=0}^{p}\beta_3\,\Delta\text{in unemployment}_{t-i} + \\ & \sum_{i=0}^{p}\beta_4\,\Delta\ln\mathrm{NPL}_{t-i} + \mu_t \qquad (2),\end{aligned}$$

where

Δ = first difference operator

$\ln\mathrm{NPL}_t$ = natural log of non-performing loan

ln GDP = natural log of gross domestic product

incipi_t = natural log of the consumer price index

$\mathrm{unemploymen}_t$ = natural log of unemployment, and

μ_t = denotes residual terms or white noise error term

Equation (2) has two components. The first component with the summation signs (Σn) is the error correction dynamics and the second component shows long-run estimates as reflected by the terms with λs. The null hypothesis is defined by H0: $\lambda1 = \lambda2 = \lambda3 = \lambda4 = 0$, where it means there is no cointegration exists in the long-run relationship. This hypothesis will be tested against the alternative hypothesis of Ha: $\lambda1 \neq \lambda2 \neq \lambda3 \neq \lambda4 \neq 0$, by the means of the F-test.

To obtain a constant elasticity in the model, all variables were first converted into logarithm form prior to conducting the cointegration test. The selection of optimal lag length will be

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conducted in the first step of the ARDL approach. This study only reports the Akaike information criterion (AIC) and final prediction error (FPE), since they appeared to be the most suitable selection criteria for small sample size (Liew 2004). The second step consists of conducting bounds F-statistics to the model developed, which latter contribute to the long-run association. To reach the results, F-statistic value generated from the test will be compared against those critical values of bound statistics provided in Pesaran et al. (2001), Table CI (iii) Case III.

The outcome might fall into three situations, which are purely I(1), purely I(0) or mutually cointegrated. First, the variables can be purely I(1) integrated if F-statistics is greater than its critical value, and hence fail to reject the null hypothesis because there is cointegration or in other words, the variables have a long-run relationship. The second output may be purely I(0), which is the vice versa to the first and third is, the variables may experience a mutually cointegrated if f-statistic falls inside critical value bounds, and it indicates that the outcome is inconclusive. The following long-run model is formed:

$$\ln \mathrm{NPL}_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \ln \mathrm{NPL}_{t-i} + \sum_{i=0}^{n} \beta_2 \ln \mathrm{GDP}_{t-i} + \sum_{i=0}^{n} \beta_3 \ln \mathrm{CPI}_{t-i} + \sum_{i=0}^{n} \beta_4 \text{ in unemployment}_{t-i} + \mu_t \quad (3)$$

The error correction model is used to examine the short-run coefficients. The specifications of the model are estimated as follows:

$$\Delta \ln \mathrm{NPL}_t = \alpha_{01} + \sum_{i=1}^{p} \alpha_{1i} \Delta \ln \mathrm{NPL}_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta \ln \mathrm{GDP}_{t-i} + \sum_{i=0}^{q} \alpha_{3i} \Delta \ln \mathrm{CPI}_{t-i} + \sum_{i=0}^{q} \alpha_{4i} \Delta \ln \mathrm{UNEMPLOYMENT}_{t-i} + \lambda \mathrm{ECT}_{t-1} + e_t \quad (4),$$

where ECM is the lagged error correction term derived from the long-run equilibrium relationship. Causality test is employed to show us the direction of causal relationship because the cointegration test that we had shown in the preceding analysis only confirms that causality exists but not the direction of causality. The direction of the causality, in this case, can only be determined by the F-statistic and the lagged error correction term, while the t-statistic on the coefficient of the lagged error correction term represents the long-run causal relationship, the F-statistic on the explanatory variables represents the short-run causal effect (Narayan and Smyth 2006). The test of causality will apply if the equations of null hypothesis of no cointegration are rejected. In other words, the causality test will be considered if the equation has long run relationship because if the equation is not been rejected by the null hypothesis, long run relationship does not exist.

4. FINDINGS

In this study, we investigate the influence of a set of macroeconomic factors, namely economic growth, inflation rate and unemployment rate on NPLs in Malaysia using quarterly data from 2008 to 2018, both in the long run and short run. To examine this linkage, we employ the ARDL bounds test procedure; in the first step, we identify the optimal lag length and in the second step, we explore their long-run and short-run relationships between the variables using ARDL bounds testing approach of cointegration.

4.1 STATIONARY TESTS

As a pre-requisite for establishing the presence of a long-run cointegration between the

variables, we first employ a stationary test. To determine the order of integration of variables, we use common unit root tests of the Augmented Dicker Fuller Test (ADF) and Phillips-Perron (PP) to test the stationarity of the variables used. The results of both tests, as reported in Table 2, present that the variables had a unit root at levels, I(0) but became stationary after first differencing I(1), except the unemployment rate which remained stationary at both levels, as follows:

Table 2: Unit root tests

Variable	ADF		PP		Stationary status	
	Level	First difference	Level	First difference	ADF	PP
LNNPL	-3.0010	-3.5031	-5.1694	-8.3206	I(1)	I(0)
LNGDP	-2.0300	-4.3323	-3.4331	-15.6092	I(1)	I(1)
LNCPI	-2.4116	-9.1926	-2.4208	-9.2580	I(1)	I(1)
LNUNEMPLOYMENT	-6.1073	-8.8483	-6.1073	-35.7747	I(0)	I(0)

Note: *, **, ***, **** statistical significance at 1%, 2.5%, 5% and 10% respectively.

When all the variables are confirmed to be integrated in the same order after the first differencing, the most appropriate lag-length was determined. Table 3 reports the optimal lag orders of the model, standing at 6 lags, as suggested by FPE (Liew 2004) and AIC.

Table 3: Optimal lag length

Lag	FPE	AIC
1	0.001677	-3.552929
6	0.001521*	-3.652475*

Note: * indicates lag order selected by the criterion

FPE: Final prediction error

AIC: Akaike information criterion

4.2 COINTEGRATION TEST – BOUNDS F-TEST

After the selection of lags is done, we apply the bound F-test approach for long-run relationships. Table 4 presents the results of the test. At 2.5 percent significance level, the F-statistics fall outside the upper critical value bounds (5.035> 4.89), which means the bounds F-test for cointegration yields evidence of a long-run relationship between the macroeconomic variables used and NPLs. This finding suggests that macroeconomic factors used in this study have long-run equilibrium relationships with the NPLs of commercial banks in Malaysia.

Table 4: Bounds F-test for long-run relationships.

Lag	NPL model, F = 5.035**	
	Critical bounds (k=3)	
Level of significance	I(0)	I(1)
1%	4.29	5.61
2.5%	3.69	4.89
5%	3.23	4.35
10%	2.72	3.77

Note: *, **, ***, **** statistical significance at 1%, 2.5%, 5% and 10% respectively. The critical values are based on Pesaran et al. (2001), Table CI (iii) Case III: Unrestricted intercept and no trend.

4.3 ESTIMATES OF LONG-RUN RELATIONSHIP

The significance of the respective variables towards the level of NPLs was analyzed individually. As shown in Table 5, results indicate that all the variables except *CPI*, are significantly related to the problem loans, proxied by NPLs. However, the channel of influence, as shown by the

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signs of variables' coefficients, appears to be mixed for GDP and unemployment. It is observed that GDP growth and NPLs are inversely correlated with a 1 percent increase in GDP leads to 0.6739 decreases in NPLs.

This is expected since a growing economy is likely will increase borrowers' income and ability to repay debts to banks. Hence, the NPLs will be reduced. Similarly, when the economic environment deteriorates, the tendency to default is high due to lower earnings earned, thus results in more problem loans. This result is consistent with that of Szarowska (2018), Mpofu and Nikolaidou (2018), Beck, Jakubik et al. (2013), Akinlo and Emmanuel (2014), and Castro (2013).

On the other hand, the labor market has a strong and statistically impact on the NPLs in the long run with a 1 percent change in the unemployment rate leads to 0.9352 percent increase in NPLs. Their relationship is shown to contribute positively to the rise of NPLs. Rising unemployment rate indicates that an economy is facing recession, which then results in loss of income source for borrowers and eventually increases the inability for debt repayments. The finding is in line with that of Szarowska (2018) and Castro (2013). Table 5 also presents the estimated ARDL models that have passed several diagnostic tests that indicate no evidence of serial correlation and heteroscedasticity.

Table 5: ARDL estimates of the long-run relationship

Regressors	Coefficients	t-statistics
LNNPL	-0.1257***	-4.3453
LNGDP	-0.6739***	-6.2654
LNCPI	0.267	0.3013
LNUNEMPLOYMENT	0.9352**	2.0949
Intercept	2.021***	3.4573
Diagnostic test statistics		
R^2	0.9944	
Adj. R^2	0.9917	
F-statistic	364.37[<0.001]	
Durbin Watson	1.8584	
Serial correlation	0.5875[0.783]	
Normality	0.9901[0.610]	
Heteroscedasticity	1.4861[0.141]	

Breusch-Godfrey test null is no serial correlation.

Jarque-Bera test null is normality.

White test null is no heteroscedasticity.

Note: *, **, and *** statistical significance at 1%, 5% and 10% respectively. p-values in parenthesis [ ]

The short-run causation is reflected through the F-statistics under the coefficients of the variables. The results of the short-run effect of macroeconomic factors on NPLs are presented in Table 6. It reveals that GDP growth, inflation, and unemployment rate are not having any effect on NPLs in the short run, suggesting a lag between the absorption of macroeconomic factors and NPLs. The findings also present that in the short run, macroeconomic factors used do not cause NPLs fluctuations. The error correction term is −0.1257 and is statistically significant, implying that 13% of deviations from the equilibrium path are adjusted in one quarter, suggesting the existence of long-run causality from macroeconomic factors to NPLs.

Table 6: ARDL short-run estimate and ECM

Regressors	Coefficients	t-statistics
ΔLNNPL	-0.0019	-0.0205
ΔLNGDP	-0.1371	-1.2865
ΔLNCPI	-0.0172	-0.1519
ΔLNUNEMPLOYMENT	0.0184	0.4256
ECM(-1)	-0.1257*	-4.6024
Diagnostic test statistics		
R^2	0.5827	
Adj. R^2	0.5006	
F-statistic	0.0557	
Durbin Watson	7.0981	
Serial correlation	0.0302	
Normality	1.9460	
Heteroscedasticity	0.5827	

Note: *, **, and *** statistical significance at 1%, 5% and 10% respectively.

Lastly, to ascertain for structural stability of the model, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum squares of recursive residuals (CUSUMSQ) tests are employed (see Figure 1). This follows the suggestion by Pesaran and Shin (1998). The results for the model show that all the plots of the CUSUM and CUSUMSQ statistics are within the critical bounds of the 5% significance level. Therefore, the null hypothesis, which states that all the coefficients in the regressions are stable, cannot be rejected.

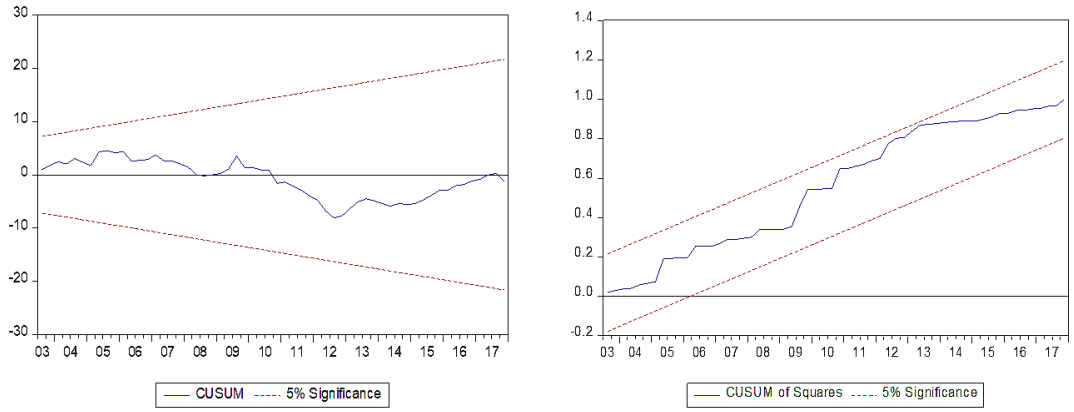

Figure 1: Stability test: CUSUM and CUSUM Squares.

5. CONCLUSION

Since the level of Malaysian economic openness is high, the performance of the financial system especially the banking institutions is ubiquitously exposed to risks of financial stress arising from global financial uncertainty. This headwind, to some greater or lower extent, can be translated into a more challenging prospect of economic growth, price instability, as well as a slower labor market participation faced by the local economy. With greater challenge, it prompts a call towards a continuous assessment on how these uncertainties affect the stability of the banking sector, of which proxied through the performance of NPLs.

This study applied the ARDL approach and bounds testing to cointegration to empirically investigate the macroeconomic influence, namely GDP growth, inflation and unemployment rate on NPLs of commercial banks in Malaysia. The results found that while these variables are not having a significant effect on the problem loans in the short run, in the long run, the relationship exists. In

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particular, GDP growth has a negative linkage with NPLs, whereas the relationship between the unemployment rate and NPLs is positive. Inflation, on the other hand, does not depict any correlation with NPLs. Owing to the vulnerability of GDP growth and unemployment rate changes to NPLs fluctuations, in the long run, loans granted to borrowers must be reviewed frequently, taking into measures the condition of overall economic environment as well as the state of unemployment in the country.

6. DATA AND MATERIAL AVAILABILITY

This study pertinent information is available by request to the corresponding author.

7. ACKNOWLEDGMENT

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