A Study on the Determinats of Credit Risk in Malaysian Banking System for the Period 1996 to 2017

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Abstract--*Given the rising bankruptcy cases in Malaysia, the significance of credit risk management acquires more awareness from the society and banking industry, resulting in the establishment of countless research papers related to the issue of credit risk management. Nevertheless, the factors that bring an impact on the credit risk in banks are less researched and analysed. Therefore, this study seeks to examine the determinants of credit risk in Malaysian banking system for the period 1996 to 2017. The selected variables are gross domestic product (GDP), unemployment rate, inflation rate, interest rate and management efficiency. This study applies autoregressive distributed lag (ARDL). The sampling frame consists of 26 Malaysian commercial banks. The research findings show that all the variables are manifested to have a significant relationship with the credit risks in Malaysian banking system. These research findings enable the practitioners to solve the issue of credit risks more productively. Bank officers could also implement a more fruitful credit risk management system after perceiving the causes of escalating credit risk in banking industry.*

Keywords--*Credit Risk, ARDL, Commercial Banks*

I. INTRODUCTION

Banks operate as financial intermediaries between two parties, by receiving deposits (money surplus/ savings) from the public and lends it to the society in need of capitals (money deficits). Banks are obliged to manage the excess and shortfall of money. Only banks are legitimated as deposit-taking institutions, also known as Monetary Financial Institutions. Normally, majority of deposits in banks are kept for shorter maturity, but loans are lent for longer maturity (Apurv and Gaurav, 2008). The amount of loans is generally higher than deposits as well in banking system. Yet, because of in equivalence and mismatch between income and expenses, banks always attempt to fill the gap between surplus and deficit units.

However, in 1997, one of the factors that occasioned the financial crisis in Asian region was immense mismatch of assets and liabilities due to the deficiency in risk management, provoking the rising of liquidity, credit, interest rate and currency risk (Zakaria *et al.*, 2010). This mismatch issue had led to the extent that some notable corporations raised foreign currency loans, promoting the massive outflow of Malaysian Ringgit. Gradually, Malaysian Ringgit depreciated sharply and hence, those corporations ran into tremendous foreign exchange losses and insolvencies due to currency mismatch and failures to hedge the exposures. This issue placed Malaysian banking system in a risky position and precipitated bad macroeconomics. Further, non-performing loans that swiftly accumulated in Asian economies after financial crisis exacerbated the assets-liabilities mismatch and economic condition. The assets-liabilities mismatch (credit bubble) and foreign

exchange risk had aroused the burst of Asian financial crisis in 1997, badly affecting Thailand, Indonesia, Korea, the Philippines, Singapore, Hong Kong, China and Malaysia (Elangkovan and Said, 2013).

On 29 September 2017, Bank Negara Malaysia (BNM), central bank of Malaysia, proclaimed that the magnitude of impaired loan in August retained stable at 1.2% of total loans net of individual impairment provisions, but the outstanding loan growth of the banking system swelled to 5.8%(TheStar, 2017). This growth generated rising credit risk and bad debt distress, casting a shadow in Malaysia banking system. Else, the credit risk is high in Malaysia owing to the nation's excessive private-sector credit level comparative to income. Besides, according to Standard & Poor's Global Rating analyst RujunDulan, an amalgamation of unproductive economic growth and higher leverage from corporate and household loans has risen the credit risk of Malaysian Banks. This phenomenon will jeopardise the performance in banking system.

Credit risk is the risk of economic loss where the counterparty is failed to repay its obligations, which is also known as non-performing loans. Credit risk is also generated by broader market when the present value of future cash flows of the amounts lend by banks modifies, because of some alterations in the financial market or the general economy of the country (Zeinab Safaei, 2011). According to Saeed MS and Zahid N research, credit risk was the most perilous element that imperilled the banks' financial condition and health. The Great Recession of 2008 arose because of the failure of banks in managing credit risks. The banks approved the loans freely based on the collateral and when collateral prices surged, banks allowed more lending (E. Stiglitz, 2009). When the real estate bubbles burst, non-performing loans leapt drastically due to economic breakdown and rising unemployment (Verick and Islam, 2010), thus subprime mortgage crisis exploded. Additionally, since the global economy catastrophe and the ensuing sovereign debt crisis, Eurozone banks have been wrestling with the non-performing loans and the European Central Bank takes the most arduous stance to grapple with bad debt to avoid crisis aggravation (Giugliano, 2017). With massive pile-up outstanding loans due to poor credit risk management, Indian banks ranks among the world worst (Anand, 2017).

All these issues manifest that credit risk management is vital and overriding to ensure banking system is financially sound and safeguard the country's economy by minimising the bad debts. Failure in credit risk management can turn into gigantic trouble in banks. This is because the banks, with correlated relationship, exercise multiple inter-bank businesses such as lending and borrowing mutually to resolve capital surplus and deficit. Indirectly, if one of the banks encounter credit mess, the risk will disseminate into the entire banking system and may eventually collapse. Therefore, all banks in the country must constantly gauge the credit risk level and diminish the potential credit risk through robust risk management techniques. Nowadays, credit risk has emerged to be a focal concern to banks, as to prevent from bank failure and economic downturn.

However, tackling and minimizing credit risk is somehow challenging to banks, because it is extremely difficult to absolutely eradicate credit risk, as there are countless factors causing the rising credit risk in banking system, be they macroeconomic and microeconomic factors. Regulators have been striving in taking some actions to diminish credit risk. After the lesson learnt from the subprime mortgage crisis, Basel Committee on Banking Supervision (BCBS) issued and proposed Basel III to global leaders during the G20 meeting in Seoul in November 2010 (Bruggink, 2010). Basel III is the international regulatory accord on bank capital adequacy, stress testing and market liquidity risk, as to foster financial stability in banking system.

In 2017, BNM had declared an exposure draft with proposed rigorous regulatory requirements on credit risk management for licensed financial institutions and banks to attain ongoing effective credit risk management (TheStar, 2017). The latest credit risk assessment stipulates that a financial institution must inaugurate sound and well-described credit acceptance criteria to expedite an ex-ante appraisal of prospective credit. All the financial institutions in Malaysia are obliged to execute the standards set out in the policy document of credit risk which is established by BNM.

Nowadays, all the banks have acknowledged the severity of credit risks to the banking system and economic development. The banks also perceive the significance of credit risk management and be prudent in lending, by only approving loan to those borrowers with qualified and good creditworthiness. However, recognition of factors that strike the credit risk in banking system should be given preliminary and prior attention so that the regulators, policy makers and the banks can tackle the rising credit risk with accurate, effective and precise solutions. This is due to the fact that credit risk management is very strenuous because of various unforeseeable macroeconomic and microeconomic factors on credit risk. Different sores must have different salves. It is cardinal to discover the real causes that influence credit risk so that it can be conquered wholly and flawlessly. As the saying goes, "pull out the evil by the roots".

This research proposes to ascertain the determinants of credit risk in Malaysian banking system. In other words, it emphasizes the factors on credit risks by scrutinizing the relationship between various variables and their significance in identifying the credit risk of banks in Malaysia. Therefore, regulators and bank management can find a more rational and functional solution to manage the credit risk in banking system, in order to avert bank collapse and financial crisis.

II. PROBLEM STATEMENT

Formerly, majority of the journals, newspaper and articles focused on the significance and effect of credit risk management on banking performance and the need to ameliorate the credit risk management. For example, recently, THISDAY Newspaper just reported the attempt of Nigerian banks in improving the credit risk management (Chima, 2018). London-based Ghana International Bank (GHIB) also publicized the recruitment of Jaywing, a credit risk analytics expert, to consult on IFRS 9 and credit grading across the trade finance, corporate loans and treasury assets of the banks, as to enhance both risk management and profitability (Finextra, 2018). Ali Sulieman Alshatti conducted his researched and published journal about the impact of credit risk management on the financial performance of Jordanian banks as well, and his conclusion highlighted that these two variables had correlated relationship (Alshatti, 2015). Also, most of the researchers tend to investigate the impact of credit risk management on the profitability of commercial banks (Fan Li, 2014)(Muthee, 2010)(Hosna, Manzura and Juanjuan, 2009).

All these examples reveal that the importance and effect of credit risk management gain more attentiveness from the society and banking industry. Nonetheless, elements and variables that affect the credit risk in banks are less researched and analysed. In fact, the factors that influence the credit risks are exceptionally vital before the best solution to credit risk management is decided. Hence, this research intends to bridge this gap.

Besides, previously, some researchers had conducted investigation and analysis on the existence of correlation between credit risk and various variables including macroeconomic, microeconomic and bank-specific factors (Mileris, 2012)(Anna Pestova, 2012)(Vania Andriani, 2015). Multiple results were found with respect to diverse countries. For instance, findings of the research carried out in Kosovo banking sector indicated that profitability, credit growth, inefficiency, deposit rate andloans to deposit ratio had a significant correlation with credit risk (Jehona Shkodra, 2017). The result of research conducted in Ghana's commercial banks showed that management efficiency and profitability had no significant relationship with credit risk (Lawrence Asamoah Adu, 2015), while in the research on commercial banks of Pakistan, the findings disclosed that GDP growth, return on asset (ROA), operating inefficiency and size had positive relation with credit risk but interest rate growth had negative correlation (Sohaib iqbal kasana, 2016).

All these findings and results reflect the variables that influenced the credit risk of the banks in different countries are diverse. This is due to the fact that every country has its own economic condition, policies and banking strategies. Thus, those findings might not be pertinent to the banking system in Malaysia. This research aims to explore whether those variables used in other countries are applicable to Malaysia.

According to world bank 2016 data, the worldwide average of non-performing loan (NPL) ratio is 3.9%. The Nigeria's NPL ratio stood 11.7%, which was the highest among other countries, while China and Malaysia had the lowest NPL ratio, which was only 1.7%. South Africa's NPL ratio was 3.2% and Russia's was 9.2% (PWC, 2017). These figures indicate that NPL ratios are diverse among different countries, thus, the credit risk is also distinct, regardless to the size of the countries. Based on the report of Moody in 2016, Maybank and CIMB Group, the largest and second largest banks by total assets in Malaysia, confronted increasing non-performing loans owing to the impairment alterations in the foreign markets such as the CIMB Group in Indonesia and Thailand, and Maybank in Hong Kong (TheStar, 2016). However, Public Bank and Hong Leong Bank, the third and fifth biggest banks (Statista, 2018), had lower credit risks. There is an issue that large banks have higher credit risks than modest banks. Thus, this research intends to bridge the gap that the credit risks are not contingent on the size of the banks but the management of banks, peculiarly credit risk management and management efficiency.

Credit risk management is very pivotal in a developing country such as Malaysia to engross the investors and uphold the attentiveness of existing investors. However, according to report of Bank Negara Malaysia (BNM), the bankruptcy cases, be they individuals, public listed corporations and private companies, had escalated from 1899 cases in June of 2013 to 2366 cases in July of 2013 (Manab, Theng and Md-Rus, 2015). This bankruptcy cases were the acutest since 1998. More and more companies were unable to meet the obligation and repay the debts. Subsequently, the banks will be affected by the bankruptcy cases and the credit risks soared. Financial soundness of the banks will be badly struck if they are failed to manage and tackle the possible credit risks. Consequently, the economic crisis might arise in the country.

Hence, the non-performing loans should be taken into account by banks to sustain the financial stability. As a result, this research proposes to determine the macroeconomic variables which engender the bankruptcy cases and lead to the growing of credit risks in the banking system. It can also assist the banks in alleviating and overseeing this threat. Thus, the banking system in Malaysia can retain the credit risks at invulnerable level and bank failure due to immense credit risks can be averted

III. LITERATURE REVIEW

The theoretical study on credit risk is credit scoring model. Credit scoring model is one of the credit frameworks exercised by banks and financial institution to approve the loans to clients. It is a statistical testing conducted by credit agency to analyse the worthiness in order to grant the credit. The agency chooses statistical attributes of the client's credit payment patterns, investigating and then establishing a credit score (Fay, 2018). This model contains both quantitative and qualitative methods that outline numerous risk aspects, such as leverage ratio, liquidity ratio, management proficiency, operating expenditure and asset quality. When all this information has been entirely analysed and inspected by credit officers and committees, the banks will grant the credit to borrower subject to the terms and conditions listed in the loan contract.

All the lending decision must be supported by foregoing detailed risk assessment, and the outcome should be made as reference for loan decision to avoid credit risk. When the outcome reveals that credit ratings and default frequencies have significant relationship, the derivation of probability from those historical data can be depended on.

This model is composed of at least six grades for functional assets and two grades for non-performing assets. The asset rating distribution ought to be beneath 30% of the advances which are classified under one rating (Lange *et al.*, 2007).

In fact, credit scoring model consists of different models, including FICO scoring model, vantage score model and other models. Different organizations apply different credit scoring models.

Moreover,the empirical literature defines that determinants of credit risk can be categorized into macroeconomic factors (external) and bank-specific factors (internal) (Hassan Al-Tamimi, 2010)(Aburime, 2008). Those factors will ascertain the research output. The macroeconomic factors are beyond the mastery of the country, while bank-specific factors are the attributes of individual bank which will influence the credit risk in the bank.

The study reveals that both internal and external factors will affect the credit risks in banking system (Maxwell Sandada, 2016)(Waqas, Fatima and Khan, 2017). Thus, both factors will be examined in this research. These variables are unemployment rate, interest rate, inflation and GDP under external factors, and management efficiency which is under internal factor.

Unemployment Rate

Unemployment rate is believed to have significant relationship with credit risk. This is because commonly, when unemployment rate is low, it shows that majority obtains a stable job and receive consistent salary monthly. They could then make repayment to the regular loan instalments without any failure. If the unemployment rate ascends, the population loses the job and could not repay the loans because of no salary and earnings.
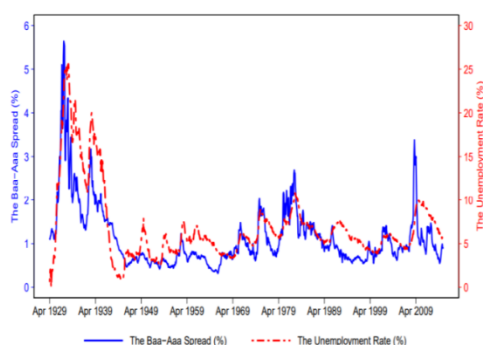
**Moody's Baa-Aaa Credit Spread and the U.S. Unemployment Rate
April 1929 - March 2015**

From the diagram, it indicates that when there is one percentage point increasing in unemployment rate, the Baa-Aaa credit spread will ascend 13.4 basis points. The measure stays sizeable at 8.7 basis points, after the command on credit risk determinants and external factors. Also, 66% variation of credit spread can be explained by unemployment rate. Credit spread is actually one of the components of credit risk. Thus, from the study, it can be said that unemployment rate and credit risk are highly correlated. According to Bai (2015), he conducted a research on the impact of labour market situation on the credit risk, after being stimulated by rigorous historical correlation between U.S. unemployment rate and Moody's Baa-Aaa credit spread. Referring to the standard Diamond-Mortensen-Pissarides (DAP) model that related the unemployment rate to defaultable debts, he utilised a reasonably calibrated model and the results showed that there was a high significant relationship between unemployment rate and credit risk. When there was economic recession, both series surged to uncommonly high level concurrently. In other words, both variables had a positive relationship.

In the study performed in Romanian banking system, the findings demonstrate that unemployment rate is positively correlated with credit risk during 2008 to 2013. This means that the higher the unemployment rate, the higher the credit risk in Romanian banking system (Bucur and Dragomirescu, 2014). In addition, using "Pearson" correlation coefficient, the results show that there is a strong relationship between unemployment rate and non-performing loans in Romania (Iuga and Lazea, 2012). The unemployment rate is also significantly correlated with the credit risk in Central and Eastern Europe (Dumitrescu, 2013). Similar result has been found in the research of Eckstein, Setty and Weiss (2017) who calibrate the model using U.S. data.

In contrast, a study in Norway indicates that there is no correlation between the unemployment rate and credit risk as the Norwegian households are able to resist a certain unemployment duration without defaulting on the loan repayment. The majority households will only confront the trouble in repaying the loan when the income is too low. Thus, instead of unemployment rate, the income level will impact more on credit risk (Kjersti-Gro, Lindquist, 2014).

However, there is a study revealing that labour market index is a more inclusive measure than unemployment rate (John E. Silvia, Azhar Iqbal, 2013). The labour market index includes six main labour market variables which incorporate more extensive information about the household and business sector, as compared to unemployment rate.

The Regression Analysis Results Independent Variable : Unemployment Rate				
Dependent Variable	**Coefficient**	**t-value**	**R²**	**RMSE**
Delinquency rates-C&I loans	0.32	4.26*	0.17	1.18
Delinquency rates-consumer loans	0.053	1.01	0.01	0.82
Delinquency rates-residential loans	1.66	15.44*	0.73	1.68
Delinquency rates- commercial loans	1.45	10.52*	0.56	2.15
Charge-off, all real estate loans	0.38	19.42*	0.81	0.3
Charge-off, C&I loans	0.2	5.94*	0.29	0.54
Charge-off, consumer loans	0.55	6.06*	0.29	1.41

*Statistically Significant at 1%

The Regression Analysis Results Independent Variable : Labor Market Index				
Dependent Variable	**Coefficient**	**t-value**	**R²**	**RMSE**
Delinquency rates-C&I loans	-0.93	-4.66*	0.2	1.16
Delinquency rates-consumer loans	-0.89	-8.37*	0.44	0.62
Delinquency rates-residential loans	-1.15	-2.11*	0.05	3.16
Delinquency rates- commercial loans	-1.3	-2.43*	0.06	3.12
Charge-off, all real estate loans	-0.49	-4.57*	0.18	0.62
Charge-off, C&I loans	-0.73	-9.65*	0.51	0.44
Charge-off, consumer loans	-1.39	-5.63*	0.26	1.44

*Statistically Significant at 1%

From John's and Azhar's research, labour market index has significant relationship with all the seven delinquency rates, but unemployment rate has significant association with only six delinquency rates, with the exception of consumer loans delinquency rates. However, it can still prove that credit risk can be affected by both unemployment rate and labour market index respectively.

Interest Rate

Interest rate is highlighted as one of the determinants of credit risk in many studies. Normally, when interest rate is high, the banks will be prudent in granting loans. The banks will limit the loan applications approval owing to the rising borrowing cost by banks. Therefore, banks will scrutinise and screen the profile of loan applicants thoroughly to ensure that they are able to repay the loans, since the burden of loans has increased due to higher interest rate. Banks will not freely approve every loan application, lowering the chances to default on loans.

There is a proof that when the interest rate drops, the lending standard will also fall, then the number of loans made by financial institutions will surge up, indirectly leading to higher default rates among those debts (Ioannidou, Ongena and Peydró, 2015)(Jiménez *et al.*, 2014).

A research is conducted to mainly focus on the firms' credit risk. The findings prove that the interest rate will affect the firms' credit risk (González-aguado Carlos, 2014). The researchers discovered that both rising interest rate and dropping interest rate will soar the default rate in short period, whereas in long run, the increasing interest rate will lead to decreasing default rate. Back to 2008, the Great Recession was triggered by the monetary policies that generated the reduction of interest rate. It is obvious that low interest rate will enhance the credit risk. For firms, they normally make the financing decision based on the cost of capital. When the loan interest rate is low, the firms tend to acquire more loans, leading to high firms' leverage ratio. High leverage ratio indicates greater burden for the firms to repay the loans, hence, the credit risks will rise. Therefore, higher interest rate will engender lower default rate in the long run.

There is an economic theory emphasizing that both market risk and credit risk are highly correlated and not separable in nature (Jarrow and Turnbull, 2000). The market risk refers to interest rate risk in banking book. Since both credit risk and interest rate risk are two dominant risks existed in commercial banking system,

Drehmann, Sorensen and Stringa (2006) tested on the relationship of these two variables. The results proved that the interest rate has strong correlation with credit risks in commercial banks. The research suggested that for a detailed and excellent risk evaluation, it is advisable to examine the impact of both correlated interest rate and credit risk together with the entire bank portfolio.

Memmel (2017) acquired empirical evidence that the large exposure of bank to interest rate risk will decrease the credit risk per total assets. Both variables have statistically negative relation. However, in China, the central bank interest rate has positive correlation with bank credit risk, but the bank lending rate has negative relationship with credit risk (Geng *et al.*, 2016). This is because the monetary policy of central bank in stabilising the price is not functional in financial stability. Both price stability and financial stability have trade-off relationship. To attain price stability, central bank will rise the interest rate, but meanwhile, inflation will occur, thus it will lead to high bank credit risk, proven by the empirical result.

Moreover, there is also an empirical result showing that low interest rate is useful for macroeconomic stability in short run, but will jeopardise the macroeconomic and financial stability in long run (Friedman, 2011). This is because low interest rate will boost the risk-taking appetite of financial institutions, leading them to exposures of losses, which is arisen from the future monetary condition threat and the postponement of balance sheets adjustment.
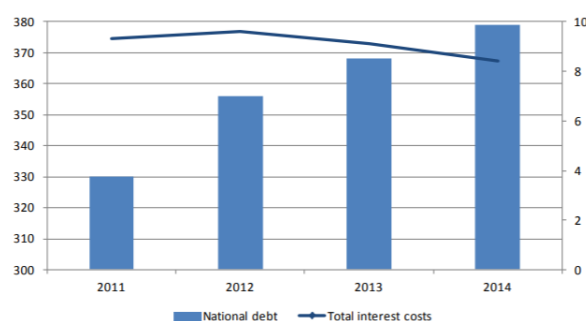
From this diagram, it proves that the national debt is also correlated with total interest costs. When the interest cost is low, the national debt will increase. Similar concept, when the interest cost decreases, the country will acquire more debts, thus lead to higher debt volume (J.F.P. Hers, J. Veerman CFA, 2015).

Inflation

Inflation is another factor that determines the credit risk level. According to the research findings of David (2004), inflation has positive relationship with credit risk. When inflation swells, the earnings of individuals and corporations will slump. Therefore, the non-performing loans will be affected and escalated due to the decrease in earnings.

It can also be said that when inflation expands in a country, the prices of goods and services soar and burden the community and businesses (Poudeland Sharma, 2013). The community and businesses will live and operate in great hardship and thus most of them might not have the ability to repay the loans obtained from banks. Consequently, the non-performing loans escalate.

Besides, when there is a leap in inflation especially during cyclical downturn, it will adversely impact on the bank efficiency. To greater extent, hyperinflation will strike the assets and equity of the banks. This will

definitely affect the credit risk in banks. Thus, Bucur and Dragomirescu (2014) found that there is a statistically positive relationship between inflation and credit risk in in Romanian banking system. Pu and Zhao (2010) also concluded in their research that inflation and credit risk has positive relationship, although the previous studies revealed that real activity and inflation were negatively correlated (Rinaldi and Sanchis-Arellano, 2006)(Shu, 2002).

Contrastingly, in Albania banking system, the inflation rate will have inverse impact on non-performing loans (Lleshanaku, 2015). Also, Marouf and Guellil (2014) also found that inflation risk brought negative influence to credit risk. Bohachova (2008) had the same result as well. He acquired the information that when there is a higher inflation rate, the banks will reduce the risk-taking on balance sheet by shrinking the number of granted loans, so the credit risk will be lowered. Besides, when the inflation is high, central bank will increase the interest rate as to reduce the credit risk in banks.

However, a study shows that the inflation is not significant in determining the non-performing loans in banks, particularly in African Financial Community (CFA) countries (Fofack, 2005). Inflationary effect will even stay stronger in non-CFA countries, because the central bank of some of these countries will assign a larger credit funds to the distressed banks, especially during economic recession. This will only intensify the inflationary pressure. Valahzaghard *et al.* (2012) also discovered that there is no significant correlation between inflation and credit risk in banking system of Iran. Also, the credit risk does not rely on the inflation in Slovenia and Nepal (Aver, 2008)(Poudel and Sharma, 2013).

Furthermore, inflation risk will also badly affect the corporate bonds. The inflation risk will emerge to be more volatile during the economic uncertainty. Kang and Pflueger (2012) performed a research by investigating the credit spread of six developed countries: U.K., U.S., Australia, Canada, Germany and Japan. They found that when there is one unit increase in inflation volatility, the credit spread of all these countries will ascend by 13 basis point. However, when there is an upsurge in inflation risk, most of the institutions will diminish the leverage ratio, therefore, the credit spreads will revert to normal after suffering the shock arisen from inflation risk.

Gdp

GDP is a popular variable used in the many researches in credit risk. The study conducted in Kenya indicates that GDP will affect the banks credit risk (Musau, Muathe and Mwangi, 2018).

Credit Risk	Coef.	Std. Err.	t	P
IFI	-5.16747	0.20851	-24.75	0.000
GDP growth rate	-0.09663	0.028927	-3.34	0.032
IFI*GDP growth rate	-0.94854	0.28704	-1.30	0.001
_cons	0.255286	0.084022	3.04	0.002
R-sq: within = 0.6865				
F statistic = 89.24				0.000

$$Credit\ Risk = 0.255286 - 5.16747 * IFI_{it} - 0.09663 GDP_{it} - 0.94854 IFI * GDP + \varepsilon_{it}$$

According to the results, it shows that when there is one unit increase in GDP, the credit risk will drop 0.0966 unit. This result reflects that GDP has negative association with credit risk. This study also suggests that the commercial banks should request the central bank and finance minister to implement a policy which will enhance the GDP of the country.

Generally, growing GDP indicates that the economic performance of the country is flourishing, the living standard and income level of the household will be improved and the business earnings of companies swell. Thus, their ability of meet the bank's loan obligation will intensify and subsequently, the credit risks in banks will wane.

Also, many researches have a findings that GDP and credit risk has negative correlation (Vicente Salas, 2002)(Jiménez and Saurina, 2005)(Das and Ghosh, 2007)(Gunsel, 2012)(Ghyasi, 2016). For example, from Jiménez's and Saurina's research, when there is 1% increase in GDP, the non-performing loan will subsequently decrease by 30.1%. This is because when the economy is doing well, the earnings of individuals and businesses will rise, which lead to the higher ability to repay the loans. Thus, the default loan will fall. From Ghyasi's research, the findings show that good economic prospect (high GDP) indicates stronger ability of the countries in achieving the financial obligations.

In contrast, there is a study signifying that GDP is positively correlated with credit risk in banks (Kelly, McQuinn and Stuart, 2013). During the blooming economy, the risk related to loans will be underestimated. This implies that GDP and credit risk has an empirical tie-up. Thus, when GDP is high (flourishing economy), the banks will be loose in screening the loan applicants, compared to the moment when economic slowdown. This will indirectly mount the credit risk in banks.

However, there is another research showing that there is no a significant correlation between GDP and credit risk in Romanian banking system (Bucur and Dragomirescu, 2014). Based on the research performed by Simons and Rolwes (2008), the short economic slump of zero GDP growth has no significant relationship with the default rate on loans. Nevertheless, a longer economic decline will still affect the credit risk in banks.

In addition, GDP will have different impact on different countries' credit risks. From the research findings of Rimpa Arunkumar (2014), both India and Korea do not show any significant relationship between GDP growth rate and credit risk. In China and Malaysia, the GDP do not affect the bond downgrades directly. Bond downgrades indicates the rising default probability (high credit risk). However, for Taiwan, the GDP growth will influence the bond downgrades. This is because the country size of Taiwan is much smaller than the large size country such as India and China. Thus, undeniably, GDP has different impact on credit risk in different countries.

Management Efficiency

Management efficiency is a bank-specific factor, which is believed to bring about implication on credit risk. Efficient management represents the act of acquiring good assets with high return and low risk, and also accepting low cost liabilities. Inefficient management will lead the banks to approve multiple unfunctional loans and investing in risky portfolio (Maxwell Sandada, 2016). As a consequence, it will provoke high credit risks.

In addition, many researchers found that management efficiency of banks will significantly affect the credit risks in banking system. In Nigeria commercial banks, there is negative relationship between management efficiency and credit risk (Onaolapo, 2012). Chinese commercial banks also run into same result that both variables are negatively correlated (Yin, Xie and Xu, 2010). Also, in Kenya, the management efficiency has statistically negative correlation with the credit risk level of deposit taking Savings and Credit Cooperative Organization (SACCO) (Festus Mithi Wanjohi, 2016).
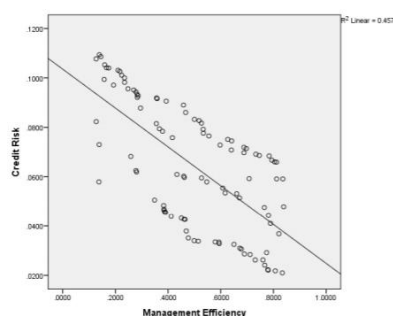
The diagram is the findings extracted from Festus's research. When there is one unit change in management efficiency, the credit risk will drop by 0.056 unit. This is because the bank is productive in generating the interest income through the outstanding assets management, leading to lesser credit risk. This result finding is identical and compatible with the research conducted by Oduro, Asiedu (2019).

Many studies make assumption that the only poor management efficiency engenders default loans, with the exclusion of other adverse economic variation that might be one of the factors. However, the procedure from the research of Monsálvez (2002) underestimated the management efficiency of the companies with bad loans triggered by adverse environment. Monsálvez employed Data Employment Analysis (DEA) technique with three phase procedures. From the output, the management efficiency will improve the credit risk in Spanish banking system, but unexpected it will deteriorate in France. It retains steady in Italy and Germany. Hence, it can be concluded that not all the countries will have the same result about the effect of management efficiency towards credit risk in banking system.

IV. RESEARCH METHODOLOGY

In this research, secondary data will be used. This is because majority of the quantitative researches apply secondary data which can be obtained from publicly available databases.

During this research, the management efficiency (asset turnover ratio) will be procured from the record in BNM bulletins over 22 periods, from year 1996 to year 2017. Since the profiles of all 26 commercial banks have already been recorded in Bank Negara Malaysia website, so the financial statements of the Malaysian banking system are all available publicly for the reference to everyone. The Malaysia interest rate, inflation rate, GDP and unemployment rate will be acquired from the government statistical database and World Bank open data.

Variables	Abbreviations Used
Credit Risk	CR
GDP	GDP
Inflation	INF
Interest Rate	IR
Unemployment Rate	UER
Management Efficiency (Asset turnover ratio)	ATR

By performing unit root test, the result shows that CR, UER and ATR series are I(0), while LGDP, LINF and IR series are I(1). Since there is a mix of I(0) and I(1), Autoregressive and Distributed-Lag (ARDL) model is more appropriate in this research, compared to Ordinary Least Squares regression (OLS) and cointegration.

ARDL is a model for time series data in which a regression model can be used to estimate the current value of dependent variable based on both prevailing values and former values of explanatory variables.

ADRL is free of residual correlation because it presumes all the variables are endogenous. Along the ARDL procedure, dependent variables and endogenous variable can be differentiated if there is presence of single long run relationship. Even though various cointegrating vectors exist, ARDL is only situated in its ascertained cointegrating vector (Nkoro and Uko, 2016).

The equations of ARDL can be written in two forms:

$$y_t = a + w_0 x_t + w_1 x_{t-1} + w_2 x_{t-2} + \ldots + \text{error term}$$

Or

$$y_t = a + w_0 x_t + w_1 x_{t-1} + w_2 x_{t-2} + \ldots + w_n x_{t-n} + \text{error term}$$

First equation reflects an infinite distributed lag model, where the dependent variable is predicted by the independent variables that are arbitrarily faraway in the past. Thus, the number of lag weights (past period) is interminable.

Second equation represents a finite distributed lag model, where there is a maximum number of lags, beyond which the values of independent variables will not affect the values of dependent variable.

In this research, a finite distributed lag model will be applied. In further detail, ARDL(2,1) is used, instead of ARDL(1,1), ARDL(1,2) and ARDL(2,2), because ARDL(2,1) provides the best results and it has the smallest AIC value.

ARDL(2,1) indicates 2 maximum lags for dependent variable and 1 maximum lag for regressor.

After selecting 2 maximum lags for dependent variable and 1 maximum lag for regressor in EViews, the model has automatically emerged as ARDL(2,1,0,1,1,1).

The diagram below shows the results of ARDL(2,1,0,1,1,1).

Dependent Variable: CR
Method: ARDL
Date: 05/13/19   Time: 17:15
Sample (adjusted): 1998 2017
Included observations: 20 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): LGDP LINF IR UER ATR
Fixed regressors: C
Number of models evaluated: 64
Selected Model: ARDL(2, 1, 0, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CR(-1)	0.570232	0.119062	4.789358	0.0014
CR(-2)	-0.259861	0.091606	-2.836733	0.0219
LGDP	-12.95419	2.859480	-4.530261	0.0019
LGDP(-1)	-7.943071	3.464981	-2.292385	0.0511
LINF	47.41020	7.340219	6.458962	0.0002
IR	1.295002	0.295075	4.388728	0.0023
IR(-1)	-1.812530	0.279134	-6.493406	0.0002
UER	1.005136	0.610347	1.646827	0.1382
UER(-1)	-1.679743	0.662487	-2.535511	0.0350
ATR	-23.36000	22.20236	-1.052141	0.3235
ATR(-1)	50.74036	19.48729	2.603767	0.0314
C	359.8394	46.23044	7.783603	0.0001

R-squared	0.997333	Mean dependent var		5.475000
Adjusted R-squared	0.993665	S.D. dependent var		4.458951
S.E. of regression	0.354907	Akaike info criterion		1.049786
Sum squared resid	1.007670	Schwarz criterion		1.647225
Log likelihood	1.502144	Hannan-Quinn criter.		1.166412
F-statistic	271.9180	Durbin-Watson stat		2.863060
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model selection.

Model Equation

CR_t = 359.8394 + 0.5702CR_{t-1} − 0.2599CR_{t-2} − 12.9542LGDP − 7.9431$LGDP_{t-1}$ + 47.4102LINF + 1.2950IR − 1.8125IR_{t-1} + 1.0051UER − 1.6797UER_{t-1} − 23.3600ATR + 50.7404ATR_{t-1}

Interpretation of P-Values

H_0: There is no significant relationship.

H_1: There is significant relationship.

Since the P-values for CR(-1), CR(-2), LGDP, LINF, IR, IR(-1), UER(-1) and ATR(-1) are smaller than the significant level of 0.05, H_0 is rejected. Therefore, CR(-1), CR(-2), LGDP, LINF, IR, IR(-1), UER(-1) and ATR(-1) have significant relationship with CR.

Since the P-values for LGDP(-1), UER and ATR are larger than the significant level of 0.05, H_0 is accepted. Therefore, LGDP(-1), UER and ATR do not have significant relationship with CR.

V. RESULT INTERPRETATION

The result will be analysed from the perspective of the impact of each independent variable on the credit risk.

Unemployment Rate and Credit Risk

Based on the research findings, the current unemployment rate has no significant relationship with the credit risk, since it has a p-value of 0.1382 which is smaller than 0.05 or 5% significant benchmark level. However, the last year unemployment rate has a significant relationship with the credit risk, because its p-value (0.035) is below 5% significant benchmark level. In more detail, last year unemployment rate possesses a significant negative relationship with credit risk, since it has a negative sign of regression coefficient (-1.6797). Therefore, when the last year employment rate decreased by one unit, the current credit risk will increase by 1.6797, holding other variables constant.

Interestingly, when last year unemployment rate decreases, this year credit risk is unexpectedly escalated. This is because when majority people obtained a job at past year, especially high-paid job, they were

desperate for a luxurious life, and would begin to chase after material possessions. They started to apply loans, in order to purchase desired mortgage and cars, and mostly, banks would approve those loans since applicants owned a good track of job payment. In addition, firms would normally gain a more profitable business during good economic time, afterwards borrowing more business loans to expand their business and to exploit tax shield. This explained the phenomenon where credit boom usually happens in good times (Prasad, Monem and Martinez, 2016). As a result, when the economy was good during last year (low unemployment rate indicates good economy in the country), majority citizens and businesses would be indebted.

Nevertheless, when economy gradually slows down in this year, most of the firms experience net loss in business and decide to reduce the salary, bonus, incentive or commission of employees, with the purpose of cutting down the operating expenses. When numerous employees face wages deduction, they suffer the reduction of financial income and promptly, their financial burdens surge. They slowly face the difficulty to repay the huge amount of loans borrowed last year, and gradually default the loan payment. This leads to the credit risk elevation in the banks. When companies take such approach, it also indicates that the companies encounter financial difficulty. Thus, the default rate of business loans will climb at the same time.

In summary, because of low unemployment rate during last year, the successful loan approval rate was high. When economic recession strikes in this year, the non-performing loans in banks soars, since people undergo financial hardship and are unable to repay the loans borrowed last year. Thus, this research findings have concluded that last year unemployment rate has negative relationship with credit risk in Malaysian banking system.

These findings are compatible with the study of Prasad, Monem and Martinez (2016) which stated that a credit boom during economic good time might lead to a surging credit risk during economic downturn, and in the end, this research found that unemployment rate was negatively correlated with credit risk in banks.

Nonetheless, these findings are contradictory with most of the other researches which derived a positive relationship between unemployment rate and credit risk, including the researches of Iuga and Lazea (2012), Bai (2015), Bucur and Dragomirescu (2014), Dumitrescu (2013), Eckstein, Setty and Weiss (2017), Souza and Feijó (2011), Donaldson and Piacentino (2015), Fei, Fuertes and Kalotychou (2012), Figlewski, Frydman and Liang (2012), Mileris (2012), Stevenson (2017), Dorraji and Abbasi (2017), Jović (2017), Ghosh (2015) and Mukhtarov, Yüksel and Mammadov (2018). All these researches perceived that when people lost a job, they would be deprived of income sources. Without earnings, they were impotent and unable to repay their loans. Thus, when unemployment rate rose, credit risk in banks would increase.

Besides, these findings are also against with the research of Kjersti-Gro, Lindquist (2014) who found that there was no relationship between unemployment rate and credit risk.

GDP and Credit Risk

According to the research findings, the last year GDP does not have any significant relationship with current credit risk, since its p-value (0.0511) is larger than the significant level of 0.05. Nevertheless, the current GDP possess a significant relationship with the current credit risk in Malaysian banking system, because it has a p-value of 0.0019 which is below the significant benchmark level. In more detail, current GDP owns a significant negative relationship with credit risk, since it has a negative sign of regression coefficient (-12.9542).

As a result, when current GDP increases by one percent, the current credit risk will decrease by 12.9542, holding other variables constant.

GDP is the supreme indicator to measure the health of a country's economy. High GDP implicates the country is moving forward and the economy is in a good structure. When the country is growing, the citizens are granted with a tip-top living standard, by having a stable and well-paid job. Corporations are also awarded with multiple big projects. Export-related companies are benefited from gigantic exports.

By having a flourishing economy with good GDP indicator, all the corporations and citizens are furnished with a strong earning power. Even if they borrow loans, they are still able to make the monthly repayment. Thus, the non-performing loans in banks will be reduced when the country is having a healthy economy. This explains the reason why GDP is found to have a negative relationship with credit risk in this research.

This result is congruous with the research findings of Musau, Muathe and Mwangi (2018), Vicente Salas (2002), Jiménez and Saurina (2005), Das and Ghosh (2007), Gunsel (2012), Ghyasi (2016), Joseph *et al.* (2012), Glogowski (2008), Espinoza and Prasad (2010), Manoj Dash (2010), Ćurak *et al* (2013), P.Louzis, T.Vouldis and L.Metaxas (2012), Thiagarajan, Ayyappan and Ramachandran (2011), Zribi1 and Boujelbène (2011), and Chen and Kang (2018). All these researches obtained the results that GDP is negatively correlated with credit risk in banking system of different investigated countries, including Spain, India, Zimbabwe and so on. They believed that when the GDP mounted up, the earnings ability of the citizens grew owing to the healthy economic condition in the country. Thereafter, almost all the borrowers are capable of repaying the loans by having stable income, contributing to low credit risk in the banking system.

However, this result inconsistent with the research finding of Kelly, McQuinn and Stuart (2013), Inekwe (2013), Ugbede, O., Otache, I., & Umar (2012), and Ganchev, Tsenkov and Stavrova (2014) who realised that the GDP is positively correlated with the credit risk in banks after completing their researches. This is because they discerned that during blooming economy (high GDP) in a particular country, banks tended to loosen the loans requirement in term of potential collateral, net operating income, personal debt-to-credit ratio and so on. Thus, this will generate potential credit risks to the banks.

Moreover, this research findings are totally clashing with the findings from the research of Bucur and Dragomirescu (2014), Simons and Rolwes (2008), and Poudel and Sharma, (2013) who obtained the result that GDP and credit risk of banks have no any significant relationship.

Inflation and Credit Risk

Based on the research findings, inflation is found to have significant relationship with credit risk, since it possesses a p-value of 0.0002 which is smaller than 0.05 significant benchmark level. To precise, inflation has a significant positive relationship with credit risk, owing to its positive sign of regression coefficient (47.4102). Therefore, when inflation rate rises by one percent, the credit risk will increase by 47.4102, holding other variables constant. It is detectable that inflation rate has a very large impact on credit risk, owing to its high beta.

Ascending inflation signals a declining purchasing power of a nation's country. When prices of goods increase, value of a single unit of currency reduces because it can only afford lesser goods and services. The

dwindling purchasing power will negatively affect the cost of living for the country citizens, eventually provoking slowdown in economic growth.

In this case, when inflation swells, all goods and services become exorbitant. Cost of living surges and basic expenses including foods, healthcare, housing and taxes also turn to be unaffordable. Inflation will add to the financial loads of every individual. When the public hardly sustain such high living cost by fixed nominal income, they will ultimately fall into the default in bank loans. This is because their earnings can merely cover the basic needs, barely to have excessive money for loans repayment. Therefore, the non-performing loans in banks increases.

Besides, when inflation aggravates, the business of companies will be attacked. For manufacturing industries, they are enforced to spend more for the raw materials due to inflated prices. As a consequence, their profits will be diminished. Inflation has also given rise to market inefficiency, adding difficulties to companies in planning long-term budget strategy. In addition, inflation has extended hidden taxes. For example, companies are required to pay higher tax for the inflated earnings. Thus, since the prices of raw materials are extortionate and the purchasing power of the public are lessened, the business profits will definitely shrink, exerting influence on their ability to repay the business loans. Consequently, the default in business loans rises and generates soaring credit risk in banks.

All these situations indicate that when the inflation increases, credit risk in banks will also increase. These research findings are accordant with the empirical studies by David (2004), Bucur and Dragomirescu (2014), Pu and Zhao (2010), Larsson (2009), Carling, Kenneth; Jacobson, Tor; Lindé, Jesper; Roszbach, (2002), Dhungana and Pradhan (2017), Khemraj and Pasha (2009), Farhan *et al.* (2012), Resatoglu (2012), and Badar, Javid and Zulfiquar (2013). All these researchers found that inflation has a positive relationship with credit risk in the banking system of studied countries, comprising Romania, Sweden, Pakistan, Nepal and so on. They realised that inflation would affect the repayment of borrowers, when the cost of living expands. The common public will suffer from fixed low income but high living expenses.

However, these research findings are different to the empirical studies by Lleshanaku (2015), Marouf and Guellil (2014), Bohachova (2008), Shingjergji (2013), Touny and Shehab (2015), Ahmad and Bashir, (2013), Otašević (2015), Vogiazas and Nikolaidou (2011) and Bucur and Dragomirescu (2014) who discovered that inflation has a negative relationship with credit risk in banks. High inflation would create awareness to bank in tightening the loan screening process. Being prudent in loan approval would lessen the probability of loan defaults, hence reducing the credit risk in banks.

Moreover, these research findings are also discordant with the empirical studies by Fofack (2005), Valahzaghard *et al.* (2012), Aver (2008), Castro (2013) and Akinkoye Ebenezer, Moses Peter (2015) who founds insignificant relationship between inflation and credit risk.

Interest Rate and Credit Risk

According to the research findings, both the last year interest rate and current interest rate is found to have significant relationship with credit risk, since their p-values (0.0002 and 0.0023) are below 0.05 significant benchmark level. In more detail, last year interest rate has a significant negative relationship with credit risk,

since it possesses a negative sign of beta (-1.8125). This indicates that when last year interest rate increased by one unit, the current credit risk will decrease by 1.8125, holding other variables constant.

When the lending interest rate augmented during last year, the money supply slumped, leading to heightening of reserve requirement. Banks were prohibited to loan more money to the borrowers. Hence, the total loans sank. Since the banks could only loan a restricted amount of money, banks would be cautious in loan screening. Besides, when interest rate rose in the last year, citizens did not engross to apply loans, as to avoid paying high loan repayment.

When there is economic recession in this year, it will not add to the non-performing loans in banks, because the loans approved last year were mostly high-quality loans which had been underwent heedful screening. Besides, since banks had reduced the total loans approved last year, the effect of economic depression will not impact much on the bank loans. Therefore, it is perceptible that high interest rate imposed last year will contribute to the deduction of current credit risks in banking system.

This result is consonant with the empirical studies by Ioannidou, Ongena and Peydró (2015), Jiménez *et al.* (2014), González-aguado Carlos (2014), Jarrow and Turnbull (2000), Drehmann, Sorensen and Stringa (2006), Memmel (2017), Friedman (2011), J.F.P. Hers, J. Veerman CFA (2015), Chen, Cheng and Wu (2011), Isabela (2013), Aliaga-Díaz and Olivero (2011), and Angeloni and Faia (2010). From their researches, a result of detecting negative relationship between interest rate and credit risk was derived. When interest rate increases, the credit risk in banking system decreases.

However, the current interest rate is detected to have positive relationship with credit risk, due to positive sign of beta (1.295). When current interest rate increases by one unit, the current credit risk will increase by 1.2950, holding other variables constant.

This is because when lending interest rate increases suddenly in this year, those people, who have previously borrowed loans charged in floating interest rate, will face extravagant loan repayment promptly. Facing unexpected rising lending interest rate, borrowers suffer from financial difficulties. For those who do not have much savings, they are failed to confront the sudden increase in current lending interest rate, thus default in loan repayment. As a result, when current interest rate increases, the credit risk in banks will increase simultaneously.

This result is compatible with the empirical studies by Geng *et al.* (2016), Mirie (2012), Espinoza and Prasad (2010), Jacobson, Lindé and Roszbach (2013), P.Louzis, T.Vouldis and L.Metaxas (2012), Aver (2008), and Nkusu (2011) who discerned that there was positive relationship between interest rate and credit risks in banks. A rise in interest rate would cause an increase in credit risk.

Nevertheless, both of the results obtained in this research are not in line with the research findings of Arewa, Ajibola, Nwachukwu, Uche and Owoputi (2013), and R.Mpofu and Nikolaidou (2018) who perceived an insignificant relationship between interest rate and credit risk in banking system.

Management Efficiency and Credit Risk

Total asset turnover ratio is used as an indicator to management efficiency in this research. Based on the research findings, the current total asset turnover ratio does not have any significant relationship with the credit risk in banks, because its p-value (0.3235) is above the 0.05 significant benchmark level.

However, the last year total asset turnover ratio is proved to have a significant relationship with credit risk in Malaysian banking system, owing to its small p-value (0.0314) which is below 0.05 significant benchmark level. To precise, last year total asset turnover ratio has a significant positive relationship with credit risk, because of positive sign of beta (50.7404). When last year total asset turnover ratio increased by one unit, the current credit risk will increase by 50.7404, holding other variables constant. Asset turnover ratio is the most influential factor to credit risk, because it owns the highest beta value.

When last year total assets turnover ratio escalates, the credit risks in banking system also heightens. This might be because when the bank managements are too ambitious to prove their ability in boosting the net revenue, they would normally charge a higher risk premium on loans, in order to gain more profits on loans. However, most of the consumers are relatively unresponsive to the alteration in loan risk premium provided they are able to obtain the loans (Durkin *et al.*, 2014). Therefore, in the last year, when consumers applied loans, a higher loan risk premium was charged. Loan applicants accepted the higher amount of monthly payment, since they could bear the expenses of higher rate.

Unfortunately, when economic downturn in this year, the earnings power of borrowers is affected. Therefore, this will certainly have an impact on the ability of borrowers in repaying a high loan risk premium, hence leading to rising credit risks in the banks.

Besides, this phenomenon happens on business loans as well. Small and medium enterprises (SMEs) would normally be charged a higher loan rate, as a policy of banks to generate more revenue from the assets. SMEs agreed with the loan rates, as they were in need of money immediately for business expansion or payment to operating expenses. Nevertheless, when current economic declines suddenly, SMEs will fall into financial distress. Loan repayment will become an immense burden to them. When those SMEs are failed to pay, the non-performing loans in banks surge and together, the credit risk mounts up.

In a nutshell, high management efficiency indicates an outstanding level of performance, but being over-desirous in making profits from higher loan charges might precipitate adverse consequence. Thus, bank managements should contemplate a reasoning and insightful approach in administering the bank revenue.

This result is inconsistent with the researches conducted by Onaolapo (2012), Yin, Xie and Xu (2010), Festus Mithi Wanjohi (2016), Huah (2017), Azrul Abdullah (2017), Garr (2013), Das *et al.*(2009) and Oduro, Asiedu and Gadzo (2019) who gained the findings showing a significant negative relationship between management efficiency and credit risk in banking system. They conceived that the more efficient the management was, the lower the credit risk would be. Among these researches, the examined countries incorporate Nigeria, China, Kenya and so on.

Furthermore, this result is also different from the research findings of Jayadev (2006) who noticed that there was no significant relationship between management efficiency and credit risk in banks.

However, there is no any past research to corroborate the findings in this research. Management efficiency might positively affect the credit risk in Malaysian banking system, but it brings about different impact on the banking system in other countries.

VI. CONCLUSION

In this study, all the variables (GDP, inflation, interest rate, unemployment rate and management efficiency) are diagnosed and manifested to have a significant relationship with the credit risks in Malaysian banking system. GDP and unemployment rate are detected to have a negative relationship with credit risk, but inflation and management efficiency are found to possess a positive relationship with credit risk. However, the last year interest rate is discovered to be negatively correlated with credit risk, distinguished with the findings on the current interest rate which has positive relationship with credit risk.

Since all these variables are verified to have an impact on credit risks, appropriate approach on managing the changes of the variables should be taken. These research findings enable the practitioners to tackle the problem of credit risks more easily and effectively. Bank officers could also practise a more efficacious credit risk management after having known the causes of rising credit risk in banking industry.

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