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Determinants of Islamic Bank Credit Risk in ASEAN Countries

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ABSTRACT

Ialamic banking system have been establish more than 30 years ago around the world. However, until today it still facing a lot of obstacles especially in term of credit risk. Thus, the aims of this study is to examine the external (macroeconomic) and internal economic factors that influencing Islamic bank credit risk in ASEAN countries. By using 29 of Islamic banking data in ASEAN from years 2011 until 2018, panel data model was applied in this study. The results from the long run regression of FLOMS, DLOS and PMG suggest management efficiency (MGT) and capital ratio (CR) are the internal factors affects the credit risk of ASEAN Islamic bank. Economic growth, inflation and interest rates are external factors that also found could influencing the Islamic bank credit risk. More research ought to be carried out so that one can understand how credit risk is created in Islamic banking. The finding obtained will provide the further understanding of how Islamic banks should tackle the obstacles they face in order to manage their credit risk.

1. Introduction

Throughout the 20th century, our perception of banks in other countries has drastically changed. Nowadays, Islamic banking is a major concept used in the banking system. The establishment of Islamic banking is the result of a sudden demand from the Muslim community who want their banking and financial matters to be handled according to the Shariah ways. As a result of this urge, that is, to have better financing according to the Islamic way, a larger demand for Islamic banking rather than conventional banks has been created. However, whether it is the Islamic banking system or the conventional one, both are influenced by credit risks. Credit risk is the risk of a counterparty failing to perform its obligations. The credit risk is an important type of risk affecting the banking sector. Robust credit risk management become an essential

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component of the long-term capability of any financial institution. Additionally, the success of a financial institutions in the future highly depends on how well the institutions manage their risk.

Islamic banking has found its niche in 76 countries for approximately 50 years and its operating systems have been developed based on the Islamic Shariah (legal system) concepts related to financial transactions (Al-Wesabi, H., & Ahmad, N.H., 2013). Adverse macroeconomics conditions such as low or negative growth domestic product, with high level of interest rates and high inflation, are favorable to banking crises (Demirguç-Kunt and Detragiache,1998). Meanwhile, internal factors such as management efficiency (MGT), leverage (LEV), natural log of total assets (LNTA) and non performing loan (NPL) influence banking crises in which NPL functions as a credit risk indicator for total loans (Rose, 1996; Berger and DeYoung, 1997; Corsetti, Persenti and Roubini, 1998; Roy, Balaji, Kesharwani, & Sekhon, 2017; Setiawan, Hasan, & Hassan, 2019).

According to Brewer, Jackson and Mondschean (1996) banking has a few loan sectors that are associated with risks. Credit Risk is a potential or tendency of bank borrowers who fail to repay their loan due to failure in meeting its obligation with the terms and conditions established by banks. As the borrower is expected to use future cash flows to compensate a current debt, credit risks will occur. By optimizing the risk-adjusted return rate of a bank, credit risk management can maintain the credit risks exposure within adequate parameters. A vital element of a wide-ranging risk management approach and crucial to any banking organization's long-term success is the effective management of credit risk.

The operations and activities of the Islamic banking system are established on Shariah rules and they act as an alternative financial system that not only monitor the uncertainty in contracts (gharar), gambling (maysir) and the prohibitions of interest (riba), but also convey significant, positive social and economic benefits or outcomes that contradict from the fundamental structure of conventional finance. Based on Chowdhury, M. (2015) studied, *gharar* is allowed in instances where the benefit outweighs the harm eventhough under Shari'ah, both *riba* and *gharar* are prohibited as their harm outweighs any benefit. Therefore, Islam forestalls Riba which exists in the customary banking transaction. Consequently, the Islamic financial framework which is free from Riba has to be established for the sake of the ummah. In addition, a person who assesses the monetary reports of both the Islamic banks and the conventional ones are likely to find that the assets side of both types of banks consists of debts. Islamic banks are assumed to have different methods of financing like mudarabah and musharakah but in actuality they center around murabahah and istisna. Perhaps the reason for this is that banking skills are highly developed and can be used to handle credit risk, while risk management for mudarabah and musharakah is still in the early stages of development. Such techniques must evolve from the indigenous efforts without the help from traditional banks ' experience (Elgari, 2003).

This paper therefore aims to examine the external and internal economic factors influencing the Islamic bank credit risk in ASEAN countries. The data of 29 Islamic banking in ASEAN for the period of 2011 to 2018 were taken from Bank scope and Osiris. This paper proceeds as follow: Section 2 reviews the previous research regarding credit risk and its determinants. Section 3 discuss about methodology and data. Section 4 present the findings and discussion of study.

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1.1 Performance of Islamic banking

The continuous liberalization of the financial sector creates more opportunities between the Middle-east and ASEAN banks, which may become a key driver in promoting trade and increasing the size of Islamic finance industry. For example Tabash, M., & Dhankar, R. (2014) found that in long run, Islamic banks' financing can promote economic growth in the United Arab Emirates (UAE).Islamic finance is expected to be able to provide not only banking and services to Muslims but also to non-Muslim customers. The first ASEAN Islamic bank was established in 1983 in Malaysia and was called Bank Islam Malaysia Ltd. Bank Islam Malaysia functions on the basis of Shariah law and succeeds in meeting its customers' savings and credit needs. Since its establishment in 1983, Islamic banking has developed rapidly in Malaysia in terms of its performance. In reality, its praiseworthy success and its presence as an alternative bank with good growth potential has made it the hallmark of Islamic banking in many Muslim countries.

The Islamic banking system first began in Thailand in 1998 when the 'Islamic window' concept was introduced by the Government Savings Bank (GSB) (Sudin Haron & KuMajdi Yamirudeng, 2003). The Bank for Agriculture and Agricultural Cooperatives (BAAC) and Krung Thai Bank both implemented a similar system in 1999 and 2011 respectively. The Thai government's establishment of the Islamic Bank of Thailand in 2003 further extended the Islamic Banking System when it became the first full-fledged Islamic Bank. Thailand is a multi-religious country with six million Muslim followers which makes Islam as the second largest religion here and it has become another key target after the enactment of the Islamic Bank of Thailand Act 2002.

Indonesia has the potential to be one of the leading countries in Islamic banking (Chusaini, 2013) since most of its population are Muslims. In 1992, the first Islamic bank known as Bank Muamalat Indonesia (BMI) was established in Indonesia. The Islamic banking industry in Indonesia has been growing positively since 1992. The latest data of January 2011 shows that there are 11 Islamic Commercial Banks (BUS) followed by 23 Islamic Banking Windows / Unit (UUS) and 151 Islamic Rural Banks (BPRS) assimilating 1796 country-wide branches (Rifki Ismal, 2011).

Three Islamic banks are currently operating in Brunei. In 1991, Brunei officially launched Tabung Amanah Islam Brunei (TAIB). TAIB was the first major undertaking by Brunei to create a comprehensive Islamic banking scheme (Salma Abdul Latif, 1993). Two years after the establishment of TAIB, Brunei formally launched its first full-fledged Islamic commercial bank called 'The Islamic Bank of Brunei Berhad' (IBB). In March 1995 the government of Brunei transformed its fully-owned conventional banks into Islamic banks completely. The government has changed the name of the bank from Development Bank Berhad (IDBB) to Development Bank of Brunei (DBB).

2. Literature review

Credit risk can be described as a consequence of a debt default that may result from the failure of a borrower to make the necessary payment (Chapra & Khan, 2000, Khan & Ahmed, 2001). Credit risk is a significant financial risk included in the default risk covering more than three-quarters of the risk in the banking book's average asset portfolios of an Islamic bank. The Islamic bank version of credit risk is in the form of payment or settlement. Credit risk occurs when the transaction party pays the money before receiving the asset or cash. Most of prior studies have used the ratio of non-performing loans (NPL) to measure the credit risks (Misman et.al, 2015, Safiullah & Shamsuddin, 2018, Sobarsyah et.al, 2020) which in banking studies, the loan is classified as NPL when the payment of interest and principal are overdue by 90 days or more. The higher NPL, tends for banks to experience lower profit margins and lead to crisis if

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the problem becomes more serious (Misman, 2015). This is mainly for contracts such as Salam or Istisna or Murabahah contracts. This situation will expose it to potential losses (Khan & Ahmed, 2001). Islamic Shariah enables collateral to be considered as protection against the risk of debt, while third-party guarantees have also been implemented to prevent credit risk in relation to the loan loss reserve (LLR).

Many of the previous researchers have focussed on two factors that drive Islamic credit risk in their study whether due to external or internal factors. The most popular of literature identified for internal factors of credit risk are driven by several bank specific variables (BSV) while some aspects argues for external factors greatly explained by macroeconomic variables such as unemployment, gross domestic product (GDP) and interest rates (Misman et. al., 2015; and Ahmet Incekara et. al, 2019). Previous study normally examined the determinants of credit risk either using BSV or macroeconomic factors as explanatory variables. Nonetheless, a few studies used both BSV and macroeconomics variables to explain the credit risk of banks. Additionally, many of literature currently combined both of aspects of bank specific variables and macroeconomic factors in their study (Safiullah & Shamsuddin, 2018; Sobarsyah et. al, 2020; Ferhi, 2017). Furthermore, the great development of Islamic banking combined with strong competition with conventional bank in the same markets show some interest for previous literature to study on comparison of credit risk between Islamic banks and conventional banks (Safiullah & Shamsuddin, 2018; Ferhi, 2017; Chamberlain, 2019; Lassoued, 2018; Kabir et. al, 2015; and Hassan et. al, 2019)

However, the results of these studies are mixed and inconclusive. More work involving new data, measurement rules and estimation techniques is required (Chamberlain, 2019). For instances, based on result from Kabir (2015), show that Islamic banks have significantly lower credit risk than conventional banks as based on Merton's distance-to-default (DD) model. In contrast, and as expected, Islamic banks display much higher credit risk using the Z-score and non-performing loan (NPL) ratio. These findings suggest that the measure chosen plays a significant role in assessing the actual credit risk of Islamic banks.

The study on credit risk in an Islamic bank is still limited compared to a conventional bank. Previously the study on Islamic bank credit risk focused more on theoretical basis. Among the early researchers in Islamic bank credit risk are Ahmad, N. H. & Ahmad, Shahrul Nizam (2004), Khan (2003), and Rahman & Shahimi (2010). The three types of funding system consist of asset based, debt based or supporting types. All the types are bound by Shariah law which is free from *riba*, *gharar* and *maysir*. Ariffin et. al (2009) indicate that Islamic financing structure encourages a risk-sharing principle which is not found in the practices of traditional banks. Under Mudharabah and Musharakah contracts, credit risk is expected to be higher among many types of contracts in Islamic finance. This is due to the asymmetric issue of data, in which the entrepreneur may not provide the bank with adequate data (Khan & Ahmed, 2001). Credit risk seems to be higher than other risks, particularly with PLS (profit-and-loss-sharing) funding methods. However, Murabahah and Ijarah which are modes of Non-PLS contracts have a higher market risk than credit risk. The market's volatility influences the rate of bank profit because of the fixed income adopted in these contracts (Khan & Ahmed, 2001).

Islamic banking risk management is still not sufficiently effective to face the main challenges of financial risk (Makiyan, 2008). Many problems need to be better understood so that innovative and suitable solutions can be applied to avoid financial risks attributed by financial products. Islamic banks are affected by the financial crisis differently from conventional banks (Hasan & Dridi, 2010). During a financial crisis, Islamic banks are impacted in a different manner as compared to conventional banks (Hasan & Dridi, 2010). Ferhi (2017) in their study in countries of MENA region claimed that "shock" variable has a positive and statistically significant impact on credit risk within both Islamic and conventional banks. Thus, it can be stressed that during the period of the financial crisis, the credit risk of Islamic and traditional banks increases. However, the comparison of the two financial sectors show that the credit risk in the conventional

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banks is higher than Islamic banks. This is due to the inherent weaknesses in risk management practices by the Islamic bank. This is a fact that Islamic banks in general were better in terms of credit and asset growth as compared to conventional banks in 2008-2009. This may indicate that in order to maintain the stability of Islamic banks after financial crises, strengthening capital regulation may not be sufficient (Sobarsyah et.al, 2020).

Thiagarajan, Ayyapan & Ramachandran (2011) found that the lagged non-performing asset (NPA) influences the current NPA positively and a significant inverse relationship exists between credit risk and GDP. Both macroeconomics factor and bank-specific factor play significant roles in influencing the credit risk of the banking system. Ahmad, Akhtar & Usman (2011) found that bank size, capital adequacy and debt equity ratios strongly affect credit risk whereby there is a positive and statistically significant relationship between them and credit risk at 0.05 per cent and 0.01 per cent levels. According to Al-Jahri & Iqbal (2001), Musharakah-Mudarabah's share in total funding is lower than Murabahah's share i.e., Murabah & Ijarah account for 75% of total funding with Musharakah-Mudarabah, Warninda (2019) found that Mudarabah is not riskier than Musharakah in Middle East, South Asia, and Southeast Asia. Mudarabah financing does not significantly seem to impact bank credit risk linearly or non-linearly. Meanwhile, Musharakah financing exhibits both linear and reversed U-shaped (non-linear) influence onIslamic bank credit risk. They estimated that bank credit risk is maximized when the proportion of Musharakah financing is between 37–39% of the total bank financing (ceteris paribus).

Meanwhile, Istisna & Salam that account for only 25%. A study by Khan & Ahmed (2001) on Islamic financial institutions in 28 countries discovered credit risk to be the highest in Musharakah (3.69 out of a score of 5) followed by Mudarabah (3.25). Their results emphasize that bankers perceive that the methods of profit and loss sharing (PLS) increase credit risk. Istisna product-deferred contracts were found to have the highest mark-up risk (3.57). Study on Malaysian Islamic banking shows that the debt-equity ratio (DER), debt to total Assets (DTAR) and Earning Multiplier (EM) which were used to measure Bank Islam's risk performance in risky business from 1984-1997 has risen over the years (Samad & Hassan, 1999). DER and EM are significantly linked to profitability. Bank Islam risk indicators are lower as compared to Bank Pertanian and Perwira Affin Bank, both of which are conventional banks. Due to its larger investment in government securities, the Islamic bank has a lower risk than the conventional banks.

The previous Islamic bank credit risk research suggests that there are two primary determinants of credit risks in banks. Bank specific variables (BSV) are the first determinant of credit risks and they have a significant relationship with commercial banks' credit exposure (Srairi, 2019; Ahmad & Ahmad, 2004; Berger & Deyoung, 1997; Angbazo, 1997; Ahmad & Ariff, 2007; Jimenez & Saurina, 2004; Cabenoyan & Strahan, 2004). The second determinant of credit risks is macroeconomic variables such as GDP, money supply, interest rates and inflation. Ali & Daly (2010) found that macroeconomics growth does affect credit risk level in banks. Additionally, Srairi (2019) also find a negative and significant relationship between GDP growth rate and credit risk. The result provides some support for the view that banks from faster-growing countries are less risky and have a lower portion of bad loans. Makiyan (2003) found that the supply of funds in the Iranian Islamic banking system is considerably dependent on changes in total deposits, changes in inflation rates and changes in variables ' time lags but it is not linked to the changes in the anticipated rate of return on loans allocated to different financial industries.

3. Methodology

The aim of this paper is to examine how external and internal factors influence the credit risk of Islamic banks. Unlike in the conventional banking, no one knows the factors that influence credit risk in Islamic banks. Using annual data from 29 Islamic banks from years 2011 until 2018 in the ASEAN region, a simple

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panel regression analysis was employed to address the objectives of the study. To look at the long-term factors that influence Islamic banks' credit risk in the ASEAN region, researchers have divided the variables into two main groups, internal and exertal factors. A few external factors involved factors outside the bank such as macroeconomic elements are consider in this study based on previous literature (Safiullah & Shamsuddin, 2018; Sobarsyah et al., 2020; Ferhi, 2017). Bank management efficiency and capital ratio also are include to represent the elements of bank's governance as a internal factors in this study. The long-run regression of Fully Modified OLS (FLOMS), Dynamic OLS (DLOS) and Ordinary Least Square (OLS) test are used in this study to analyze the determinants of Islamic Bank Credit Risk in ASEAN Countries.

3.1 Panel unit root tests

Before the cointegration analysis was carried out all the data was integrated in the same order. For this purpose, the first-generation test for panel unit root by Im, Pesaran and Shin (2003) and Maddala and Wu (1999) was utilized. For the second-generation test of panel unit root, Pesaran (2005) method was utilized. These two tests are more powerful and less restrictive when compared to the panel unit root developed by Levin and Lin (1992 & 2002). The tests by Im, Pesaran and Shin (2003) permit heterogeneity in the coefficient of autoregression. Indirectly these tests can solve the issues of serial correlation. The panel unit root test equation by Im, Pesaran and Shin is as follows:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{\rho} \emptyset_{ij} \Delta y_{i,t-j} + \varepsilon_{i,t}; i = 1,2, \ldots . , N; t = 1,2, \ldots . T, \quad (1)$$

where $y_{i,t}$ in our model represents each variable under consideration, α_i stands for the fixed effect and to make the residual uncorrelated over time ρ is chosen. The null hypothesis $\rho_i = 0$ for all i versus the alternative hypothesis is that $\rho_i < 0$ for some $i = 1, \ldots , N_1$ and $\rho_i = 0$ for $= N_1 + 1, \ldots , N$. The individual ADF statistics is averaged based on IPF statistics and can be written as follows:

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} (t_{iT}) , \quad (2)$$

The ADF is based on the country specific ADF regression where t_{iT} is the ADF *t-statistics* for country i, as in Eq (1). The null hypothesis of non-stationary which is under IPS shows the $\bar{t}$. Statistics follows the normal standard distribution asymptotically. Where, t_{IPS} , the standardized

statistics can be written as:

$$t_{IPS} = \frac{\sqrt{n} \left(\bar{t} - \frac{1}{N} \sum_{i=1}^{N} E \left[t_{iT} | \rho_i = 0 \right] \right)}{\sqrt{\frac{1}{N} \sum_{i=1}^{N} Var \left[t_{iT} \mid \rho_i = 0 \right]}} \quad (3)$$

Maddala and Wu (1999) argue that the tests carried out by Im et al. relax the hypothesis of root homogeneity across the units. Maddala and Wu recommend the use of Fischer type test which is based on the combination

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of the p-values, π_i of the test statistic for a unit root in every cross-sectional unit. The MW test statistic λ is given by:

$$\lambda = -2 \sum_{i=1}^{N} ln\ \pi_i \,. \tag{4}$$

The MW test statistic is arranged as chi square with 2N degrees of freedom under the hypothesis of cross-sectional independence. It is stated that IPS test is not powerful when it includes individual trends, Breitung (1999). The MW test is susceptible to deterministic trends specification as compared to the IPS test. It has its own MW test benefits in which its value does not rely on distinct lag length in the individual ADF regressions. Maddala and Wu and Breitung also discovered that the MW test is more competent as compared to the test by IPS.

The tests (IPS and MW) each has a flaw in supposing that the cross-section is autonomous; the same assumption was made in all first-generation of panel unit root. Despite this, it has been pointed out in the literature that cross-sectional reliance arises owing to non-observed prevalent factors, externalities, linkages between regional and macroeconomics, and unaccounted residual interdependence. Each experiment (IPS and MW) has the fault of assuming that the cross-section is autonomous; the same assumption was produced in the root of the first generation of panel units. Recently some new panel unit root test has appeared, addressing the issue of reliance and correlation considering the incidence of dynamics and linkages in macroeconomics. These tests are called the second-generation panel unit root tests. The well-known test of the second generation regarded in this article is Pesaran's CIPS test. Pesaran (2005) examines the following Cross-Sectional Augmented Dickey-Fuller (CADF) regression in order to formulate a panel unit root test with cross-sectional dependence, estimate the OLS technique for the ith cross-section in the panel:

$$\Delta y_{it} = \alpha_i + \rho_i\, y_{i,t-1} + \delta_i\, \bar{y}_{t-1} + \sum_{j=0}^{k} \delta_{ij}\, \Delta\, \bar{y}_{i,t-j} + \sum_{j=0}^{k} \Delta y_{i,t-j} + \varepsilon_{it} \tag{5}$$

where, $\bar{y}_{t-1} = \left(\frac{1}{N}\right) \sum_{i=1}^{N} y_{i,t-1}$, $\Delta \bar{y}_t = \left(\frac{1}{N}\right) \sum_{i=1}^{N} y_{it}$, and $t_i(N,T)$ is the *t*-statistics of the estimate of ρ_i as shown in the above equation and is used for computing the individual ADF statistics. Pesaran suggests CIPS test statistics which is constructed on the average of individual CADF statistics which is shown belew:

$$CIPS = \left(\frac{1}{N}\right) \sum_{i=1}^{N} t_i\ (N,T). \tag{6}$$

Pesaran (2005) tabulates the critical values for CIPS for various deterministic terms.

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3.2 Panel cointegration tests

Once the order of stationary was established, Predroni's cointegration test methodology was applied. In fact, like the IPS and MW panel unit root, the panel cointegration experiments suggested by Pedroni (1999) also take heterogeneity into consideration by using specific parameters that can differ across individual sample members. Such heterogeneity signifies an advantage because it is impractical to assume that the cointegration vectors are similar for the panel between one individual and another.

Implementing the cointegration test by Pedroni relies on estimating the following long-run relationship:

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1,it} + \beta_{2i} x_{2,it} + \cdots + \beta_{Mi} x_{M,it} + \varepsilon_{it}$$

for $i = 1,\ldots,N$; $t = 1,\ldots,T$; $m = 1,\ldots,M$

(7)

where N denotes the number of individual members in the panel; T refers to the number of observations over time; M indicates the number of exogenous variables. The estimated residual structure is as follows:

$$\hat{\varepsilon}_{it} = \hat{\rho}_i \, \hat{\varepsilon}_{it-1} + \hat{u}_{it} \, .$$

(8)

In order to test panel data cointegration, Pedroni has suggested seven different statistics. Four of these seven statistics are based on pooling, the so-called "Within" dimension and the last three are based on the "Between" dimension. Both types of tests concentrate on the non-cointegration null hypothesis. However, the difference stems from the alternative hypothesis specification. The alternative hypothesis is $\rho_i = \rho < 1$ for all i, for all of the tests based on "Within," whereas the last three test statistics which are centered on the “Between” dimension, the alternative hypothesis is $\rho_i < 1$, for all i.

Pedroni has tabulated the finite sample distribution for the seven statistics through Monte Carlo simulations. To reject the null hypothesis of lack of cointegration, the calculated statistical tests must be lower than the tabulated critical value.

3.3 Panel cointegration estimation

Although Pedroni’s methodology enables us to test the cointegration presence, it could not present the long-run relationship estimation. Several estimators are suggested for the panel framework in the presence of cointegration: Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS). Chen, McCoskey and Kao (1999) analyzed the OLS estimator's properties and discovered that the bias-corrected OLS estimator generally does not enhance the OLS estimator. The findings suggest that alternatives in cointegrated panel regressions, such as the FMOLS estimator or the DOLS estimator may be more ensuring. However, Kao and Chiang (2000) indicate that both OLS and Fully Modified OLS (FMOLS) reveal a small sample partiality and the DOLS estimator seems to outdo both estimators.

Three estimators with error correction are examined in this paper: Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) empirically examine the validity of the Feldstein-Harioka puzzle in ASEAN countries.

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3.4 The Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) estimators

Kao and Chiang (2000) propose the Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) methods to estimate the long-run vector of cointegration for non-stationary panels. These estimators correct the standard pooled OLS for serial correlation and regressor endogeneity that usually occur in a long-run relationship.

Let us take into consideration the fixed effect of the panel regression below:

$$y_{it} = \alpha_i + x'_{it}\beta + u_{it}, \qquad i = 1, \dots, T, \tag{9}$$

where y_{it} is a matrix (1, 1), β is a vector of a slope $(k,1)$ dimension, α_i is individual fixed effect, μ_{it} are the area stationary disturbance terms. It is assumed that $x_{it}(k,1)$ vector are integrated processes of order one for all i, where:

$$x_{it} = x_{it-1} + \varepsilon_{it}. \tag{10}$$

Under these specifications, equation 9 defines a system of cointegrated regression with x_{it}. The limited distribution of FMOLS and DOLS estimators in co-integrated regressions shows that they are asymptotically normal (Kao and Chiang, 2000). The FMOLS estimator is structured by making corrections to the OLS estimator for endogeneity and serial correlation and is explained as:

$$\hat{\beta}_{FM} = \left[\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \bar{x}_i)'\right]^{-1}\left[\sum_{i=1}^{N}\left(\sum_{t=1}^{T}(x_{it} - \bar{x}_i)\,\hat{y}_{it}^{+} + T\hat{\Delta}_{\varepsilon\mu}^{+}\right)\right], \tag{11}$$

where $\widehat{\Delta}_{\varepsilon\mu}^{+}$ the serial correlation is a term and $\hat{y}_{it}^{+}$ is the transformed variable of y_{it} for the correction of endogeneity. It is also possible to correct the serial correlation and endogeneity using the DOLS estimator. The DOLS is an extension of the estimator of Stock and Watson (1993). DOLS estimator uses parametric adjustment to the errors to obtain an unbiased estimator of the long-run parameters by including the past and future values of the differenced I(1) regressors. The dynamic OLS estimator is obtained as follows:

$$y_{it} = \alpha_i + x'_{it}\,\beta + \sum_{j=-q_1}^{j=q_2} c_{ij}\,\Delta x_{i,t+j} + v_{it}. \tag{12}$$

where c_{ij} is the coefficient of a lead or lag first differenced explanatory variables. The estimated coefficient of DOLS is given by:

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$$\hat{\beta}_{DOLS} = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} z_{it}\, z'_{it}\right)^{-1}\left(\sum_{t=1}^{T} z_{it}\, \hat{y}_{it}^{+}\right) \quad (13)$$

where $z_{it} = \left[x_{it} - \bar{x}_i, \Delta x_{i,t-q}, \ldots, x_{i,t+q}\right]$ is 2(q+1) x1 vector of regressors.

The empirical model of this study is written as follows:

$$\boldsymbol{IBCR_{it}} = \boldsymbol{\alpha} + \boldsymbol{\beta 1 MGT_{it}} + \boldsymbol{\beta 2 CR_{it}} + \boldsymbol{\beta 3 GDP_{it}} + \boldsymbol{\beta 4 CPI_{it}} + \boldsymbol{\varepsilon_{it}} \quad (14)$$

Where;

i. $IBCR_{it}$ is the Islamic banks credit risk for bank *i*, *t* taken for the period 2011- 2018,

ii. MGT_{it} is the management efficiency for bank *i*, *t* taken for the period 2011- 2018,

iii. CR_{it} is the capital ratio for bank *i*, *t* taken for the period 2011- 2018,

iv. GDP_{it} is the Gross Domectic Product for countries *i*, *t* taken for the period 2011- 2018. It is a proxy for economic growth and,

v. CPI_{it} is the Consumer Price Index for countries *i*, *t* taken for the period 2011- 2018. It is a proxy for inflation.

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4. Findings and discussion

Table 1 show the results of panel unit root tests for the ASEAN Islamic banks for individual intercept unit root system, individual intercept and trend and none. This shows that the unit roots 'null hypothesis for the Islamic bank credit risk panel data and internal factorcs of Islamic banks cannot be rejected at level. It was also found that the unit roots for the Islamic bank credit risk panel data and external factors for Islamic banks cannot be rejected at level. From this empirical panel unit root test, the hypothesis is rejected when series are in first differences. Therefore, a panel cointegration test can be carried out between Islamic banks credit risk and Islamic banks internal and external factors.

Table 1. Panel unit root for Islamic Bank Credit Risk in ASEAN, 2011-2018

	Individual Intercept				**Individual Intercept and Trend**					**None**		
	Levin et al	Im et. al	Pesaran (ADF)	PP	Levin et al	Breitung	Im et. al	Pesaran	PP	Levin et al	Pesaran (ADF)	PP
$IBCR_{it}$	-2.442*	0.109	14.438	21.421*	0.832	2.289	1.013	7.669	15.098	-2.583*	27.197*	38.182*
$DIBCR_{it}$	-3.899*	-0.780	-18.77**	22.37*	-3.200*	0.00005	0.0840	15.623	26.861*	-3.420*	32.454*	43.397*
MGTit	-0.4182	-1.432**	24.818*	4.739	-4.368*	2.001	0.185	15.059	29.756	2.629*	21.664**	24.226*
DMGTit	-6.922*	-1.805*	24.490*	35.726*	-8.660*	-1.105	-0.148	15.389	25.821*	-2.137*	40.638*	21.806**
RCRit	-1.009	0.951	8.648	7.692	-4.651*	-2.216*	0.341	9.293	12.098	0.081	8.941	18.61
DRCRit	-7.776*	-2.646*	29.088*	39.758*	-8.256*	-5.120*	-0.416	16.877	35.181*	-6.498*	50.246*	54.772*
GDPit	-2.799*	0.612	8.365	14.655	-3.337*	0.172	0.468	10.426	16.941	4.603	0.629	0.186
DGDPit	-7.728*	-2.336*	32.267*	46.142*	-7.449*	-4.972*	-0.257	17.797	28.749*	-5.124*	44.402*	48.755*
CPIit	-0.554	2.473	6.037	15.669	12.450*	-1.481**	-2.591*	51.446*	98.142*	12.905	0.016	0.0001
DCPIit	14.436*	-6.938*	69.620*	92.605*	14.498*	-0.299	-1.852*	41.160*	91.290*	-3.625*	30.088*	34.920*

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The results of Pedroni's (1999) co-integration tests between the credit risk of Islamic banks and internal and external factors of Islamic banks are shown in Table 2. The in-group or intergroup monitoring was used to check that the panel data were co-integrated. The columns marked within-dimension include the calculated value of the statistics based on estimators which pool the autoregressive coefficient for the unit root tests on the estimated residuals across different countries. The columns marked inter-dimensional report the statistics calculated value based on estimators that average individually estimated coefficients for each country. Except for the v-statistical test, the findings of the in-group test and the intergroup test indicate that the null hypothesis of no cointegration cannot be rejected at a significant level of 1 percent. Therefore, the ratios of Islamic bank credit risk and bank internal and external factors are cointegrated for the panel of all ASEAN Islamic banks.

Table 2. Pedroni Panel cointegration test results, 2011 – 2018

Within-dimension (panel)		
Test	**Statistic**	**Weighted Statistic**
***v*-Stat**	-0.951	-0.883
ρ -Stat	0.729	0.897
PP-Stat	-7.493*	-5.159*
ADF-Stat	-4.818*	-3.339*
Between-dimension (group)		
rho-Stat	1.621	
PP-Stat	-6.671*	
ADF-Stat	-4.022*	

Notes: Trend and time-dummies results. The test statistics is normalized so that the asymptotic distribution is standard normal. *, **, *** suggest rejection of the non-cointegration null hypothesis at the significant level of 10, 5, and 1 percent, based on critical values of 1,281, 1,644 and 2,326 respectively.

The existence of a long-term relationship between Islamic bank credit risk and internal and external bank factors is economically significant in that it indicate that ASEAN Islamic bank fulfils the condition of long-run solvency. Having found that there is a co-integrating relation between variables, it is convenient to use a panel co-integrating estimator to estimate the credit risk of Islamic banks and the coefficient of internal and external factors of banks. A variety of panel cointegrating estimators is used in this paper: The Fully Modified OLS, the Dynamic OLS, and the Pooled Mean Group.

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Table 3. Pedroni Panel cointegration test results, 2011 – 2014

Variables	FMOLS		DOLS		OLS	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Internal Factors						
MGT*it*	0.327*	(2.280)	1.365*	(4.288)	0.963*	(3.505)
CR*it*	-1.179*	(-5.098)	0.546*	(2.196)	0.428*	(2.066)
External Factors						
CPI*it*	-1.423	(-0.662)	-15.347*	(-6.261)	-16.296*	(-5.487)
GDP*it*	-0.839*	(-2.426)	0.469	(0.800)	0.275	(0.732)

Three methods were used to calculate the cointegrating vector: FMOLS, DOLS, and OLS estimators. Table 3 shows the outcome of the regression of FMOLS, DOLS, and OLS factors affecting Islamic banking credit risk in ASEAN countries. For the Islamic bank internal factors, it was found that management efficiency (MGT) and capital ratio (CR) influence the Islamic banking credit risk for all the three models. These findings are in line with Ahmad, N. H. & Ahmad, Shahrul Nizam (2004) and Catherine Soke Fun Ho & Nurul Izza Yusoff (2009). The stability of Islamic banks' internal factors is an important strategy for credit risk management within the banking system. Inefficient management of internal factors could lead to losses for banks. Good practices in regulating Islamic banks should ensure that credit risk can be minimised. Low credit risk is extremely critical to the success of a bank over time. The direct cause of most bank institution failures is credit risk management failures due to internal factor management failures that will shrink capital via loan losses.

The external factor model indicates that the gross domestic product (GDP) and inflation rate (CPI) have a long-term effect on Islamic bank credit risk. This finding is consistent with Petr Jakubik (2007), Al-Wesabi, H., & Ahmad, N.H. (2013) and Waemustafa, W., Sukri, S. (2015). This illustrates that credit risk can be influenced in the long term by economic growth and inflation. Such variables, however, are beyond the reach of banking institutions. But to be resilient, banks need to prepare how to manage all the possibilities that these external factors create.

5. Conclusion and recommendation

Generally external factors involved factors outside the bank such as macroeconomic elements and the internal factor involved elements of bank's governance such as bank management efficiency and capital ratio are included in this study. The results of the long-run regression of FLOMS, DLOS and OLS suggest that for internal factors, ASEAN's managerial efficiency (MGT) and capital ratio affect credit risk of Islamic banks. Meanwhile, the external factors such as economic growth and inflation affect the Islamic bank credit risk for the ASEAN region are found significant. The finding from this study, added important evidence to existing literature on Islamic banks credit risk in ASEAN countries. In conclusion, further studies by other researchers are needed to understand how credit risk is shaped in Islamic banking. The results obtained would help major players strategies for Islamic banks on how to handle credit risk.

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