Factors Affecting Credit Risk in Indonesian Islamic Banks

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Abstract

This study uses dynamic panel data methods to examine the factors affecting credit risk in Indonesian Islamic banks. The panel data is collected from 11 full-fledged Islamic banks and 22 Islamic business units (windows) in conventional banks from 2004-2012, taking into account both macroeconomic variables and bank-specific variables. The Generalized Method of Moments (GMM), as proposed by Arellano and Bond (1991), is utilized to estimate the model. The results show that the GDP growth rate and the unemployment rate with a one-year lag have a strong effect on the level of the non-performing financing. Moreover, bank-specific variables such as bank's diversification and financing structure have a positive effect on the problem financing although its direction is not as expected. It is hoped that the findings could draw attention to factors affecting credit risk in Islamic banks so that credit risk can be properly managed.

Keywords: Credit risk, Islamic banks, panel data, generalized method of moments

1. Introduction

Indonesia experienced a banking crisis between 1997/1998, and reached its peak, which was characterized by the closure of 16 private banks on 1st November 1997. In addition, the government has closed seven banks in April 1998 and 38 banks in March 1999 due to illiquidity and insolvency as a result of credit defaults, fraud, and liquidity mismatches. Therefore, it can be seen that the Indonesian banking industry suffered problems mostly due to credit default by borrowers. Moreover, the last global financial crisis, which has been referred to by many economists as the worst economic or financial crisis since the great depression in the 1930s, due to excessive and imprudent lending by banks over a long period, has heightened the importance of credit risk management.

Credit risk is defined as the potential of a bank borrower or counterparty to fail in meeting the obligations in accordance with agreed terms (BCBS, 2000; IFSB, 2005). Despite the ongoing efforts to control bank-financing activities, problem financing is still a major concern for Islamic banks. The unique characteristics of the financial instruments render Islamic banks to a unique form of credit risk. The relationship between bank and customers or depositors in conventional banks is mainly based on the debtor-creditor relationship. Therefore, credit risk will exist in almost all of their operations. Islamic banking activities are more comprehensive as compared to conventional banks. They include being a trader, partner and *wakil* (agent). Thus, according to Akkizidis and Khandelwal (2008), Islamic banks have a different orientation toward risks. They are more aligned on the basis of contract types as a result of the special structuring of the contracts in Islamic banking. Hence, Islamic banks face credit risk in most of the modes of financing that they use (Elgari, 2003). Credit risk exists in Islamic banks due to managing financing in *murabahah*, investing on business performance in *musharakah* and *mudarabah* contracts, leasing in the *ijarah*, promising to deliver or to buy in *istisna* and *salam*, and *sukuk* held to maturity in the banking book. Moreover, credit risk is attributed to delay, defer and default in payments from counterparties (IFSB, 2005; Akkizidis and Khandelwal, 2008).

A survey of literature reveals that there are two distinct types of credit risk factors, namely factors influencing the systematic credit risk and factors influencing the unsystematic credit risk (idiosyncratic). Aver (2008) and Castro (2012) point out that the systematic factors refer to macroeconomic factors,

changes in economic policies, political changes and the goals of leading political parties. Meanwhile, the unsystematic factors are primarily the factors of individual customers, such as their personality, their financial solvency and capital, credit insurance and general terms and conditions.

Over the last several years, three strands of research in the field of bank credit risk have received great amount of attention. The first strand investigates macroeconomic factors as potential factors of credit risk. According to Louzis, Vouldis and Metaxas (2011), most empirical studies examine the influence of the macroeconomic environment on credit risk. In particular, Jimenez and Saurina (2006), Rinaldi and Sanchis-arellano (2006), Jakubik (2007), Aver (2008), Nkusu (2011) and Castro (2012), among others, concentrate their research essentially on the influence of macroeconomic variables over the credit risk growth and stress that those variables should be included into the analysis since they have considerable influence on the changes of credit risk.

The second strand of the literature highlights the impact of bank specific factors on problem loans (credit risk). Several studies in the banking literature examine the relationship between bank-specific factors and credit risk. In particular, Berger and DeYoung (1997), Fischer, Gueyie& Ortiz (2000), Jiménez and Saurina (2004) and Ahmad and Ariff (2007), among others, concentrate their research on the impacts of bank-specific factors over bank credit risk.

The last strand of literature combines the systematic and unsystematic credit risk factors. Several studies have appeared by using this approach, in particular, Das and Ghosh (2007), Bonfim (2007),(Louzis et al., 2011), Thiagarajan, Ayyappan and Ramachandran (2011), Zribi and Boujelbène (2011) and Suhartono (2012), among others, focus their study on the impact of macroeconomic variables as well as bank-specific variables over bank credit risk.

The objective of this study is to determine the key factors affecting credit risk in Indonesian Islamic banks by employing macroeconomic factors and bank-specific factors as independent variables to be estimated. The remainder of the paper is organized as follows. Section 2 provides literature review and hypotheses. Section 3 describes data and methodology. Section 4 provides findings and discussions, and lastly, section 5 provides some concluding remarks and recommendations.

2. Literature Review and Hypotheses

Macroeconomic Factors of Credit Risk

The theoretical framework for macroeconomic factors of credit risk is based on the life-cycle theory of consumption developed by Franco Modigliani and his student Richard Brumberg in the early 1950s (Deaton, 2005) and extended further by Lawrance (1995).The theory explains that probability of default depends on the GDP, unemployment rate and inflation rate (macroeconomic factors) and the amount of loan taken (bank-specific factor). Many studies have utilized the GDP, unemployment rate and inflation rate as the independent variables in their study. Empirical studies by Bikker and Hu (2001), Salas and Saurina (2002), Jimenez and Saurina (2006), Das and Ghosh (2007), Boudriga, Taktak and Jellouli (2009), Thiagarajan, Ayyappan and Ramachandran (2011) and Castro (2012) have confirmed the negative relationship between GDP rate and the problem loans (credit risk). In addition, empirical studies by Bikker and Hu (2001),Rinaldi and Sanchis-arellano (2006) and Castro (2012) have revealed that unemployment rate and inflation rate have negative relationship with the problem loans.

GDP growth rate

Real GDP growth provides information regarding the economic development of the country, which represents total compensation to employees, gross profits for incorporated and non-incorporated firms, and taxes less any subsidies. Thus, an increase in the real GDP rate should influence negatively the problem financing given the increase in the repayment capacity of the people. Thus, the following hypothesis is formulated:

(H_1)   There is a negative relationship between GDP growth and bank's credit risk.

Unemployment rate and inflation rate

The unemployment rate provides information regarding the impact of economic conditions, which indicates the uncertainty of future income, thus influence the repayment capacity. Therefore, an increase in the unemployment rate should influence positively the problem loans due to a decrease in the repayment

capacity. Furthermore, the inflation rate represents an increase in the general price level of goods and services of the country, thus influences the repayment capacity. Therefore, an increase in inflation rate should positively influence the problem loans due to a decrease in the repayment capacity. Thus, the following hypothesis may be formulated:

(H₂)   There is a positive relationship between unemployment rate and bank's credit risk.
(H₃)   There is a positive relationship between inflation rate and bank's credit risk.

Bank-Specific Factors of Credit Risk

The theoretical framework for developing the hypotheses for bank-specific factors is based on agency theory and efficiency-risk hypothesis. The agency theory postulates that, "the separation of ownership and management function may lead to the principal-agent conflicts as the managers may pursue their interest at the expense of the principals" (Fama, 1980). Meanwhile, the efficiency-risk hypothesis formulates possible mechanisms relating efficiency and problem loans (credit risk). Berger and DeYoung (1997) specifically formulate two hypotheses relating efficiency and problem loans: bad management hypothesis and skimping hypothesis.

Financing growth

The relationship between financing growth and credit risk can be explained by using agency theory. According to the theory, management compensation structures in banks can generate perverse incentives. Once managers obtain a reasonable return on equity for their shareholders, they may engage in activities that depart from the firm's value maximization. To the extent that managers have limited liability, a manifestation of this possibility could be to favour high risk-return strategies (i.e., over extension of credit) in order to increase the social presence of the bank managers or the power of managers in an enlarging organization. Thus, the following hypothesis may be formulated:

(H₄)   There is a positive relationship between financing growth and bank's credit risk.

Bank capital

According to the agency theory, banks with relatively low capital respond to moral hazard incentives by increasing the riskiness of their loan portfolio, which results in higher problem financing (NPF) on average in the future. In other words, banks will increase loan portfolio without considering the loan quality. To compensate for the low capital, bank managers might increase loan growth at the expense of the (future) loan quality (Berger & DeYoung, 1997). Several empirical studies have revealed that a bank's capital has a negative relationship with problem loans (credit risk) such as study by Kwan and Eisenbeis (1997), Boudriga et al. (2009), Misman (2012) and Louzis et al. (2012). Thus, the following hypothesis may be formulated:

(H₅)   There is a negative relationship between capital adequacy regulation and bank's credit risk.

Bank size

From the agency theory perspective, the large banks have more resources to discover unobservable behaviour (due to moral hazard or adverse selection) by investing in information systems such as budgeting systems, reporting procedures, and additional layers of management. Furthermore, the larger banks have more resources to ensure that the loan quality remains good. In addition, the larger banks have more resources to practice loan underwriting, monitoring and control, thus reduce agency problem or moral hazard. The larger banks can utilize personnel skill, particularly in managing credit risk. Previous studies by Salas and Saurina (2002), Ahmad and Ahmad (2004), Zribi and Boujelbène (2011), Rahman and Shahimi (2010) and Thiagarajan et al. (2011) revealed a negative relationship between a bank's size and credit risk. Thus, the following hypothesis may be formulated:

(H₆)   There is a negative relationship between bank size and bank's credit risk.

Bank profitability

From the agency theory perspective, the higher the profit that banks generate, the more money or resources are available, to ensure that the loan quality remains good and to practice robust loan underwriting, monitoring and controlling, thus reducing the agency problem or moral hazard. It is also argued that banks with high profitability may be less pressured to revenue creation and thus less constrained to engage in risky credit offerings (Boudriga et al., 2009). Thus, the following hypothesis may be formulated:

(H₇)   There is a negative relationship between bank profitability and bank's credit.

Bank Diversification

Another part of the literature has been interested in the analysis of the relationship between the diversification and bank's credit risk. From the agency theory perspective, diversification can rectify agency problems by improving the transparency of the bank's returns as a signal of the agent's effort and by reducing the risk borne by the agent for any given contract (Marshall et al., 1984). In addition, Aron (1988) also argued that diversification is worth because of the potential benefits of improved information that reduces the cost of agency contracting. Thus, the following hypothesis may be formulated:

(H_8)   There is a negative relationship between diversification and bank's credit risk.

Ownership concentration

It is argued that the agency problem is larger when ownership is diffuse or a large number of shareholders contribute a relatively small share to bank capital. The justification for this argument lies in the fact that the diffusion of ownership increases the cost of monitoring managerial activities and it might lead to higher agency costs (Junarsin & Ismiyanti, 2009). Similarly, Berle and Means (1933) argued that dispersed ownership reduces the effective power of shareholders to control the management of the firm. Thus, the following hypothesis may be formulated:

(H_9)   Concentrated ownership of a bank can reduce the bank's credit risk.

Cost efficiency

This study also utilizes cost efficiency as credit risk factors in Indonesian Islamic banks. Several empirical studies have appeared in the literature to examine the relationship between efficiency and credit risk. Berger and DeYoung (1997) found that decreases in cost efficiency are related to increases in problem loans. Inefficient managers will not cope successfully with the process of granting and monitoring loans that will reduce the banks' credit quality and bring about a growth in problem loans. In a similar vein, Kwan and Essenbeis (1997) revealed that there is a positive effect of inefficiency on risk-taking. In addition, they support the moral hazard hypothesis that poor performers are more vulnerable to risk-taking than high-performance banking organizations. This study examines and tests risk-efficiency hypotheses proposed by Berger and DeYoung (1997), specifically to test bad management hypothesis. Thus, the following hypothesis may be formulated:

(H_10)   There is a positive relationship between cost efficiency and bank's credit risk.

Financing structure

Financing structure may also determine bank's credit risk. Islamic banks offer financing facilities in the form of profit and loss sharing, debt-based and supporting mode of financing. Misman (2012)shows that financing structures and several bank-specific variables have a significant relationship with credit risk. Specifically, the study shows that equity-based financing has a positive significant impact on credit risk in Malaysian Islamic banks. This is in line with Mohd. Ariffin, Archer and Karim (2009) which argue that equity-based financing (PLS) carries much higher credit risk, and also consistent with the view of Sundararajan and Errico (2002), which pointed out that PLS modes of financing face some difficulties in the application, which are: administration of PLS modes is more complex than conventional financing, lack of standardization due to the availability of a large number of ways to finance, there is no legal caveat to control the relationship with entrepreneur and PLS modes cannot systematically be made dependent on collateral or other guarantees to reduce credit risk. Thus the following hypothesis may be formulated:

(H_11)   There is a relationship between financing structure and bank's credit risk.

3. Data and Methodology

Data Set

The data set is an unbalanced panel consisting of data for 11 full-fledged Islamic banks and 22 Islamic Business Unit Bank (windows) in conventional banks operating in Indonesia spanning from December 2004 until December 2012. Meanwhile, 2 Islamic windows were excluded from the study since these 2 banks have data for only one year. Furthermore, the data of macroeconomic variables (GDP growth, unemployment rate and inflation rate) are obtained from World Bank and Bank Indonesia Statistics. Meanwhile, the data of bank-specific variables are obtained from the Financial Services Authority and the respective banks.

Table 1 presents macroeconomic variables and bank-specific variables used in the model equation for the period of 2005 to 2012. In general, Indonesia's economy during 2005-2012 performed well amid a

slowdown and uncertainty in the global economy. Economic growth was maintained at the robust level of above 5%, except in the 2009 as the impact of the global financial crisis in 2007/2008. Further, over the span of 2005-2012, the unemployment rate also decreased from 11.20% in 2005 to 6.10% in 2012. It implies that the favourable economic conditions have created significant employment opportunities for the people. Meanwhile, the inflation rate was also maintained at a low level, especially during the last four years.

Table 1
Some Variables Used in the Model Equation

Variable	2005	2006	2007	2008	2009	2010	2011	2012
GDP growth *	5.69	5.50	6.53	6.01	4.63	6.20	6.49	6.23
Unemployment rate*	11.20	10.30	9.10	8.40	7.90	7.10	6.60	6.10
Inflation rate **	17.11	6.60	6.59	11.06	2.78	6.96	3.79	4.30
NPF ***	2.82	4.75	4.07	3.95	4.01	3.02	2.52	2.22
Financing growth ***	34.51	34.23	36.68	36.69	22.75	45.42	50.56	43.51
BOPO ***	78.91	76.77	76.54	81.75	84.39	80.54	78.41	74.75
ROA ***	1.35	1.55	2.07	1.42	1.48	1.67	1.79	2.14
CAR ***	12.41	13.73	10.67	12.81	10.77	16.25	16.63	14.13
Other operating income to operating income ratio ***	9.90	10.31	11.29	11.19	11.27	11.47	15.21	14.84

Sources: * World Bank ** Bank Indonesia *** Financial Services Authority of Indonesia

Furthermore, during 2005-2012 Islamic banking showed a positive development, with the financing channeling by Islamic banking consistently experienced an upward trend with a highest growth of 50.56% in 2011. Along with the growth of financing, Islamic banking financing quality also improved for all financing portfolio during 2005-2012. This quality improvement is reflected by a low percentage of non-performing financing (NPF). Further, the profitability level also experienced an upward trend. This condition was also supported by improvement in the Islamic banking operational efficiency level (BOPO ratio) and profitability (ROA). Meanwhile, Islamic banking capital condition, as represented by capital adequacy ratio (CAR), was considered to be high with the average of more than 10% during 2005-2012. The capital growth was relatively slower compared to financing growth. It would bring pressure on capital, especially on the side of bank core (tier 1) capital. And lastly, diversification of Islamic banks experienced and upward trend, as represented by the increase of other operating income to operating income ratio.

Dynamic Panel Data Estimator

This study utilizes the dynamic panel data set to identify the key factors affecting credit risk and to examine the relationship between financing structure and credit risk in Indonesian Islamic banks. A dynamic panel data model is a model in which the lagged dependent variable appears on the right-hand side of the equation (Baltagi, 2005). The panel data set allows the study to observe on cross-section Islamic banks, over a several times series. The simplest dynamic panel model is where the dependent variable follows an AR (1) process by including the lagged dependent variable, y_{it-1}, along with x_{it}, as a regressor:

$$y_{it} = a_i + \beta y_{it-1} + \alpha X_{it} + \varepsilon_{it} \qquad (1)$$
$$\varepsilon_{it} = v_i + \mu_{it}$$

Where the subscripts *i* and *t* indicate the cross-sectional and time dimension of the panel sample respectively, α is a scalar, and β and X_{it} (explanatory variable) are each *k* x 1.

In order to accurately estimate the relationship between credit risk and explanatory variable, the study consistently utilizes the one-step Generalized Method of Moment (GMM). The GMM estimation of Arellano and Bond is based on the first difference transformation of Equation (1) and the subsequent elimination of bank specific effects:

$$\Delta y_{it} = \Delta y_{it-1} + \beta(L)\Delta X_{it} + \Delta\varepsilon_{it} \qquad (2)$$

Where Δ is the first difference operator. In the equation (2) the lagged dependent variable, Δy_{it-1}, is by construction correlated with the error term, $\Delta\varepsilon_{it}$, imposing a bias in the estimation of the model.

Nonetheless, y_{it-2}, which is expected to be correlated with Δy_{it-1} and not correlated with $\Delta\varepsilon_{it}$ for $t = 3,...,T$, can be used as an instrument in the estimation of equation (2), given that ε_{it} are not serially correlated. This suggests that lags of order two, and more, of the dependent variable satisfy the following moment conditions:

$$E|y_{it-s}\Delta\varepsilon_{it}| = 0 \text{ for } t = 3,...,T \text{ and } s \geq 2 \qquad (3)$$

Furthermore, we test the overall validity of the instruments by implementing the Sargan/Hansen test. The Sargan test has a null hypothesis of "the instruments as a group are exogenous". Therefore the higher *p*-value of the Sargan statistic the better (Mileva, 2007). In addition, we assess the fundamental assumption of serially uncorrelated errors, ε_{it}, by testing the hypothesis that $\Delta\varepsilon_{it}$ are not second order autocorrelated. Rejection of the null hypothesis of no second order autocorrelation of the differenced errors implies serial correlation for the level error term and thus an inconsistency of the GMM estimates.

Econometric Model Specification

The study estimates the baseline model with only macroeconomic variables in equation (1) in the following form:

$$\Delta NPF_{it} = \beta \Delta NPF_{it-1} + \sum_{k=0}^{1} \delta_k \Delta GDP_{t-k} + \sum_{k=0}^{1} \gamma_k \Delta UN_{t-k} + \sum_{k=0}^{1} \lambda_k \Delta INF_{t-k} + \Delta\varepsilon_{it} \qquad (4)$$

Where $\varepsilon_{it} = v_i + \mu_{it}$

With $|\beta| < 1$, $i = 1,...,33$ and $t = 1,...,9$.

Next, the authors add of the bank-specific variables to the baseline model of equation (4) in order to examine its additive explanatory power. Thus, the equation (2) is extended to account for the additional bank-specific factors:

$$\Delta NPF_{it} = \beta_0 + \beta_1 NPF_{it-1} + \sum_{k=0}^{1} \delta_k \Delta GDP_{t-k} + \sum_{k=0}^{1} \gamma_k \Delta UN_{t-k} + \sum_{k=0}^{1} \lambda_k \Delta INF_{t-k} +$$
$$\sum_{k=1}^{2} \alpha_k \Delta LOAN_{it-k} + \beta_2 CAR_{it} + \beta_3 SIZE_{it} + \beta_4 ROA_{it} + \beta_5 DIVER_{it} + \beta_6 EFF_{it} + \beta_7 DOC1_{it} +$$
$$\beta_8 DOC2_{it} + \beta_9 DOC3_{it} + \beta_{10} DAB + \beta_{11} DDB + \beta_{12} DSB + \Delta\varepsilon_{it} \qquad (5)$$

Where,
$i = 1,2,3,4,5,6,7,8,9,10,...,33$; $t = 1,2,3,4,5,6,7,8,9$

In this study, credit risk is proxied by non-performing financing (NPF or non-performing loan/NPL in the conventional terms), which is financing that are either past due at least 90 days or in non-accrual status divided by total financing. It has been utilized, among others, by Rose (1996), Berger and DeYoung (1997), Corsetti et al. (1998), Ahmad and Ahmad (2004) and Castro (2012) as a proxy for credit risk. In the equation (5), ΔNPF_{it} is the first difference of the ratio of problem financing (the amount of non-performing financing to total financing) of the Islamic bank. The ratio of non-performing financing (NPF) to total financing outstanding is utilized as a proxy for credit risk. The NPF of one period is closely related to the previous period. Thus, one year lagged of NPF is included into the model. The lagged NPF can positively influence the current NPF level because the problems financing of one year are not completely written off and has a carryover effect. Thus, the coefficient of NPF_{it} should be positive. Equation (4) and (5) are consistently estimated using the Generalized Method of Moments (GMM) as proposed by Arellano and Bond (1991) and generalized and extended by Arellano and Bover (1995) and Blundell and Bond (1998).

Furthermore, the real GDP growth rate (ΔGDP_{t-k}) is included into the model to measure aggregate economic activity. GDP is the most general and most direct measure of macroeconomic developments. It is regarded as the first and foremost indicator of the demand for banking services, including the extension of loans, and the supply of funds, such as deposits. The current rate, as well as one lag, are included into the model to gauge the timing. It is expected that the coefficient of real GDP growth to be negative.

Unemployment rate and inflation rate indicate the uncertainty of future income, thus influence the repayment capacity. As real GDP growth rate, the current rate as well as one lag of unemployment rate (ΔUN_{t-k}) and inflation rate (INF_{t-k}) are included into the model to gauge the timing. It is expected that the coefficient of the unemployment rate and inflation rate to be positive.

For the bank-specific factor, the study includes the financing growth as the explanatory variable. $\Delta LOAN_{it-k}$ is the financing growth rate for each bank lagged one and two periods. A target of high growth in financing can force the bank to reduce the quality of its financing. However, since the financing is granted till it becomes a bad financing, there is a lag unknown and variable. Thus, to gauge the timing, the study includes the lagged one and two of the financing growth. The coefficient of this variable is predicted to be positive.

Furthermore, the study includes bank regulatory capital to risk-weighted assets (CAR_{it}). The capital adequacy ratio (CAR) provides a tool to control excessive risk-taking by banks and to prevent them from being insolvent (Boudriga et al., 2009). According to Koehn and Santomero (1980), banks under pressure to increase capital will reach the desired level by increasing the risk of assets and eventually increases credit risk. The higher the capital adequacy ratio, the lower the bank's credit risk. Therefore, the coefficient of bank capital is expected to be negative.

$SIZE_{it}$ is a relative size measure, which is the ratio between the assets of bank i in year t and total assets of all Islamic banks in year t. A bank's size is expected to have a negative relationship with problem financing (credit risk). This is because the large banks have more resources to discover unobservable behavior (due to moral hazard or adverse selection) by investing in information systems such as budgeting systems, reporting procedures, and additional layers of management. Furthermore, the larger banks have more resources to ensure that the loan quality remains good. Thus, the coefficient of bank size is expected to be negative.

Furthermore, ROA_{it} represents bank profitability. ROA shows how profitable a bank's assets are in generating revenue. Thus, it can be seen that banks with high ROA are considered to have effective credit risk management since they can manage credit portfolio, thus lowering loan loss provision.

$DIVER_{it}$ is diversification opportunities that are proxied by other operating income as a share of total operating income. This ratio reflects banks' reliance on other types of income, except for financing making and therefore on diversified sources of income (Louzis, Vouldis, & Metaxas, 2012). As pointed out by McAllister and McManus (1993), the banks that have better risk diversification opportunities could lower cost of funding and eventually the better financing quality. Thus, it is expected that the coefficient of diversification to be negative.

The study measures the efficiency level of each bank (EFF_{it}) through the ratio between operating expenses and operating income. The inefficient managers will not cope successfully with the process of the granting loans and monitoring loans that will lower the banks' credit quality and bring about a growth in problem financing. Kwan and Eisenbeis (1997) revealed that there is a positive effect of inefficiency on risk-taking. They support the moral hazard hypothesis that poor performers are more vulnerable to risk-taking than high-performance banking organizations. Thus, the coefficient of efficiency is expected to be positive.

The model equation also includes the ownership concentration dummies (*DOC*) proxied by three level of shareholding (10%, 25% and 50%). It is expected that the ownership concentrations have a negative relationship with credit risk. *DOC1* is a dummy that is one in case there is at least one owner with shareholding greater than 10% and zero otherwise. *DOC2* is a dummy that is one in case there is at least one owner with shareholding above 25% and zero otherwise. While, *DOC3* is a dummy that is one in case there is a controlling owner with more than 50% of the shares and zero otherwise.

The model also intends to examine the relationship between financing structures and credit risk. Thus, the financing structure dummies are included in the model equation (2). *DAB* represents a dummy variable that is one for offering asset-based financing and zero otherwise. While, *DDB* is a dummy variable that one for offering debt-based financing and zero otherwise. Lastly, *DSB* represents a dummy variable that one for offering supporting-based financing and zero otherwise.

4. Findings and Discussions

Descriptive Statistics

Table 2 presents the summary of the descriptive statistics of the dependent variable and independent variables. The table shows the mean, minimum, maximum and standard deviations in order to provide an insight into the distribution of the underlying variables. In average, the ratio of non-performing financing (NPF) of Indonesia Islamic banks is about 2.35 percent (from 2004 to 2012). This figure can be considered low as compared to the amount of financing. Macroeconomic and microeconomic indicators also show a good development.

Table 2
Descriptive Statistics Summary

	Mean	Minimum	Maximum	Std. Dev.
Dependent Variable				
NPF	2.346963	0.01	21.52	3.054217
Independent Variables				
GDP growth	5.656542	4.63	6.49	0..733997
Unemployment	6.337103	6.1	11.2	1.588061
Inflation	6.594252	2.78	17.1	3.742097
CAR	20.15449	1.8	73.44	23.34318
Financing growth	92.71276	-50.13	895.06	131.5914
Efficiency	80.46276	-106.15	362.62	110.5643
Size	3.797701	0.01	44.83	8.717985
Diversification	21.91944	0.31	92.75	18.84918
ROA	2.093785	-17	121.11	9.063008

Regression Results

Equation (4) and (5) are estimated using the Arellano-Bond GMM estimator in Stata. Furthermore, in order to test the hypotheses regarding the key factors affecting credit risk (credit risk factors) in Indonesian Islamic banks, 12 separate regression models were conducted for each of the dependent variables, including the baseline model, which contains the macroeconomic factors. In addition, in order to accurately estimate the relationship between credit risk and explanatory variables, the study consistently utilizes the one-step Generalized Method of Moments (GMM) to explicitly tackle problems associated with "small size, potential endogenous regressors, heteroskedasticity and the dynamic nature of the explanatory variables" (Arrellano and Bond, 1991; Arrellano and Bover, 1995).

The study also tests the overall validity of the instruments by performing the Sargan specification test, which, under the null hypothesis of valid moment conditions, is asymptotically distributed as chi-square (Arrellano and Bond, 1991; Arrellano and Bover, 1995; Blundell and Bond, 1998). Furthermore, the fundamental assumption of serially uncorrelated errors, ε_{it}, was tested by testing the hypothesis that $\Delta\varepsilon_{it}$ are not second-order autocorrelated. Rejection of the null hypothesis of no second-order autocorrelation of the differenced errors implies that the serial correlation for the level error term and thus inconsistency of the GMM estimates (Louzis, Vouldis and Metaxas, 2011).

Models with macroeconomic factors

In the baseline model with macroeconomic factors, the lag dependent variable (NPF_{t-1}) is treated as endogenous in the estimation. Meanwhile, all the macroeconomic factors are treated as exogenous in the estimation. The primary concern is to test some hypotheses about the credit risk factors. The authors also transform the dependent variable and the independent variables, since all the variables are a truncated variable (between zero and one) that is no suitable for the GMM procedure (Salas and Saurina, 2002).

Table 3
GMM Estimation Result for the Model with Macroeconomic Factors

Variables	Coefficient	Std. Error	*t*-Statistics
NPF_{t-1}	0.3875	0.1062	3.65***
GDP growth rate (ΔGDP_t)	-1.4371	0.5574	-2.58***
GDP growth rate with 1 lag (ΔGDP_{t-1})	-0.9509	0.5352	-1.78*
Unemployment rate ($\Delta UNEMP_t$)	1.4065	0.9873	1.42
Unemployment rate with 1 lag ($\Delta UNEMP_{t-1}$)	-2.0302	0.8241	-2.46**
Inflation rate (ΔINF_t)	-1.8928	0.9416	-2.01**
Inflation rate with 1 lag (ΔINF_{t-1})	2.0713	0.7559	2.74***
Sargan's test (S)		17.21 (13)	
First order autocorrelation (m_1)		-3.50	
Second order autocorrelation (m_2)		-0.28	

Notes: The degree of freedom for the Sargan test is reported in brackets.
*** Denote significance at 1% respectively.
** Denote significance at 5% respectively.
* Denote significance at 10% respectively.

Table 3 presents the individual lag one-step GMM coefficients estimations, standard error and *t*-statistics for the baseline model with macroeconomic factors. The table also shows the Sargan, first-order autocorrelation (m_1) and second-order autocorrelation (m_2) test results at the bottom of the table. The

hypothesis of a significant negative first order (m_1) and no second-order serial correlation (m_2) and the hypothesis of the validity of the instruments used (Sargan's test) are not rejected. Thus, the model is considered to have both the consistency of estimators and the validity of the instruments used.

As shown in the Table 3, the majority of the explanatory variables have a coefficient of the expected sign, but they are not always statistically significant. The coefficient of the lagged dependent variable (NPF_{t-1}) is positive and statistically significant at 1% level. The implication is that NPF is likely to increase when it has increased in the previous year. It is because the NPF of one year are not completely written off and has a carryover effect.

In addition, the coefficient of the current GDP growth rate and the one lag of GDP growth rate are negative and statistically significant at 1% and 10% level respectively, which imply that it negatively affects the credit risk as predicted by the life-cycle theory of consumption. This result is consistent with the findings of Bikker and Hu (2001), Salas and Saurina (2002), Jimenez and Saurina (2006), Das and Ghosh (2007), Boudriga et al. (2009), Thiagarajan et al. (2011) and Castro (2012), which have confirmed the negative relationship between GDP rate and credit risk.

Furthermore, the current and one lag of the unemployment rate have a different direction. The coefficient of the current unemployment rate, even though statistically insignificant, has a positive relationship with credit risk. Meanwhile, the lagged one-year is negative and statistically significant at 5% level, thus contradicting our expectation of a positive relationship as predicted by the life-cycle theory.

The coefficient for the current inflation rate is negative and statistically significant at 5% level, thus contradicting our expectation of a positive relationship with credit risk. Meanwhile, the one lag of the inflation rate has a positive relationship and statistically significant at 1% level, as predicted by the life-cycle theory. The one lag of the inflation rate has more impact to credit risk, as the coefficient value is larger than the current inflation rate. This result is consistent with the findings of Bikker and Hu (2001), Rinaldi and Anchis-Arellano (2006), and Castro (2012), which have confirmed the positive relationship between inflation rate and credit risk. The inflation rate represents an increase in the general price level of goods and services of the country, thus influences the repayment capacity. The positive sign of the one lag of the inflation rate implies that the high inflation rate will reduce the borrowers' repayment capacity after one year, thus increases the credit risk of Islamic banks.

Based on the above results, it can be concluded that the majority of the macroeconomic factors affect credit risk of Indonesian Islamic banks, except for the lagged one-year of the unemployment rate and the current inflation rate which have an opposite direction, contrary to the theory. Thus, it can be further concluded that the hypothesis one (H_1) of a positive relationship between the GDP growth and credit risk is supported, as expected by the life-cycle theory of consumption. Meanwhile, the hypothesis two (H_2) of a positive relationship between the unemployment rate and credit risk is rejected, and the hypothesis three (H_3) of a positive relationship between the inflation rate and credit risk is inconclusive.

Baseline models with bank-specific factors

Table 4 present the GMM estimation results for credit risk factors when bank-specific factors are included into the models. As in the baseline model, a general remark is that the incorporation of bank capital factor in the baseline model does not affect the differential quantitative impact of the macroeconomic factors. In other words, the inclusion of bank-specific factors into the baseline model has no significant effect on the signs of macroeconomic factors.

Based on the above empirical evidence, it can be concluded that while most of the results are in support of the hypotheses, others are not in support. The findings support the hypotheses H_1, H_4, H_6, H_7, H_9, H_{10}, and H_{11}. Hence, the empirical evidences show that the key factors affecting credit risk in Indonesian Islamic banks are: GDP growth, financing growth, bank size, profitability, cost efficiency, ownership concentration, unemployment rate, bank's capital and diversification.

However, the empirical evidence does not support hypotheses H_2, H_5, and H_8. The results revealed significant impact, but in the opposite direction as predicted by the theory, for the factors unemployment rate, bank's capital, and diversification. Therefore, the results reject the hypotheses H_2, H_5, and H_8. Furthermore, the empirical evidence does not fully support the hypothesis H_3 as the results show that the current inflation rate is negative and statistically significant, thus contradicting our expectation of a positive relationship with credit risk. Meanwhile, the one lag of the inflation rate has a positive relationship and statistically significant, as predicted by the theory.

Table 4: GMM Estimation Result for the Baseline Model with Bank-Specific Variables

Variables	Model 1		Model 2		Model 3		Model 4
NPF_{t-1}	0.406**		0.642***		0.513***		0.281**
	(2.49)		(3.08)		(4.03)		(2.41)
ΔGDP_t	-0.783		-1.203***		-1.494**		-1.263**
	(-1.13)		(-2.16)		(-2.43)		(-2.19)
ΔGDP_{t-1}	-1.550**		0.101		-0.721		-0.919*
	(-2.28)		(0.18)		(-1.21)		(-1.64)
$\Delta UNEMP_t$	6.3467		1.558		5.275***		2.345**
	(1.01)		(1.03)		(2.79)		(2.03)
$\Delta UNEMP_{t-1}$	-2.920**		-1.920**		-0.296		-1.115
	(-2.14)		(-2.41)		(-0.26)		(-1.11)
ΔINF_t	-7.4593		-1.925		-6.282***		-2.926***
	(-1.12)		(-1.26)		(-3.09)		(-2.57)
ΔINF_{t-1}	2.6478**		2.169***		-0.079		1.008
	(2.18)		(2.98)		(-0.07)		1.02
$\Delta Loan_{it-1}$	0.310**	CAR_t	0.791*	$Size_t$	-2.557**	ROA_t	-0.326*
	(2.43)		(1.77)		(-2.51)		(-1.83)
$\Delta Loan_{it-2}$	0.1092						
	(1.13)						
Sargan's test (S)	51.46 (40)		19.50 (16)		7.59 (12)		21.35 (19)
m_1	-2.95		-2.37		-3.13		-3.76
m_2	-0.77		-0.59		0.46		0.40

Variables	Model 5		Model 6		Model 7		Model 8
NPF_{t-1}	0.284**		0.300***		0.349***		0.431***
	(2.42)		(3.21)		(3.37)		(3.98)
ΔGDP_t	-1.703***		-0.795*		-1.469***		-1.228**
	(-2.91)		(1.70)		(-2.65)		(-2.10)
ΔGDP_{t-1}	-0.460		-0.489		-0.982*		-0.199
	-0.77		(-0.99)		(-1.86)		(-0.41)
$\Delta UNEMP_t$	1.417		1.384		1.562		1.184
	1.43		(1.49)		(1.57)		(1.24)
$\Delta UNEMP_{t-1}$	-2.271***		-1.695**		-1.898**		-1.689**
	(-2.73)		(-2.13)		(-2.31)		(-2.06)
ΔINF_t	-1.967**		-1.903**		-2.085**		-1.387
	(-2.07)		(-2.18)		(-2.19)		(-1.58)
ΔINF_{t-1}	2.222***		1.726**		1.914**		1.979***
	2.93		(2.36)		(2.54)		(2.63)
$Diver_t$	0.853*	Eff_t	0.786***	DOC_1	-0.067	DOC_2	-0.815***
	1.86		(3.35)		(-0.26)		(-2.82)
Sargan's test (S)	21.35 (19)		49.88 (25)		29.39 (19)		27.25 (19)
m_1	-3.09		-4.00		-3.47		-3.73
m_2	-0.35		-0.49		-0.24		-0.35

Variables	Model 9		Model 10		Model 11		Model 12
NPF_{t-1}	0.391***		0.450***		0.349***		0.360***
	(3.82)		(3.90)		(3.02)		(3.33)
ΔGDP_t	-0.173		-1.482**		-1.238**		-1.497***
	(-0.41)		(-2.56)		(-2.40)		(-3.01)
ΔGDP_{t-1}	-0.221		-0.957*		-0.983		-1.056*
	(-0.43)		(-1.72)		(-1.50)		(-1.72)
$\Delta UNEMP_t$	0.153		1.798*		1.286		1.231
	(0.15)		(1.65)		(1.00)		(0.84)
$\Delta UNEMP_{t-1}$	-2.615***		-2.231***		-2.011**		-2.136**
	(-2.82)		(-2.58)		(-2.36)		(-2.55)
ΔINF_t	-0.741		-2.385**		-1.837		-1.711
	(-0.83)		(-2.23)		(-1.39)		(-1.10)
ΔINF_{t-1}	2.576***		2.245***		2.016***		2.186***
	(3.16)		(2.83)		(2.66)		(2.86)
DOC_3	-1.241	DAB	-0.286	DDB	-0.465***	DSB	0.289
	(-1.90)		(-1.07)		(-3.61)		(0.52)
Sargan's test (S)	31.81 (19)		26.20 (19)		18.82 (15)		22.45 (19)
m_1	-3.40		-3.91		-3.18		-3.23

Variables	Model 5	Model 6	Model 7	Model 8
m_2	-0.44	-0.38	-0.45	-0.08

Notes: The degree of freedom for the Sargan test is reported in brackets.
*** Denote significance at 1% respectively.
** Denote significance at 5% respectively.
 * Denote significance at 10% respectively.

In addition, the empirical evidences also do not support the relationship between the financing structure and credit risk (H_{11}), as the results show that only the debt-based financing has a significant negative impact on credit risk. Meanwhile, the asset-based financing and the supporting-based financing do not have a significant impact on credit risk. Therefore, the results seem inconclusive. The reason for this result is because the financing using debt-based is higher compared to asset-based and supporting-based financing in Indonesia Islamic banks.

5. Conclusions and Recommendations

In this study we use dynamic panel data methods to examine the factors affecting credit risk in Indonesian Islamic banks. We find that macroeconomic variables, specifically the GDP growth rate and the unemployment rate with one-year lag have a strong effect on the level of the non-performing financing. Moreover, bank-specific variables such as bank's diversification and financing structure have a positive effect on the problem financing although its direction is not as expected by the theory.

By providing empirical evidence on the key factors affecting credit risk in Indonesian Islamic banks as well as the relationship between financing structure and credit risk, it is hoped that this study could enhance greater understanding on credit risk management frameworks. Furthermore, this study helps to add to the limited literature on credit risk management by providing insight into credit risk management that is being practiced by Islamic banking in Indonesia. In other words, this present study has made a small contribution in enhancing the existing literature on credit risk management development in Indonesia since there is no comprehensive documentation of credit risk management practices of Indonesian Islamic banks. In addition, this study would act as a catalyst for other researchers besides developing the foundation for further research in this area for the benefits of both parties especially the existing practitioners. All related parties such as academicians, researchers and practitioners have to complement each other and work together for the benefit of the nation. Furthermore, the findings of this study could lead to more innovations in credit risk management practices.

The study also contributes to the practices of credit risk management in Indonesian Islamic banks. Islamic banks may find that the results of the study are useful to design their credit risk management framework and system. In addition, the findings may guide the Islamic bankers in pursuing policies that enhance credit risk management practices for Islamic banks.

There are several contributions to policies and regulations that can be gleaned from the findings.For instance, evidence suggests that a rapid expansion of financing by Islamic banks may lead to poor financing quality, albeit a lag. A rapid expansion of financing is often achieved by sacrificing financing quality. The reason for this argument is because a target of high growth in financing may compel the bank to reduce the quality of its financing. Therefore, in order to prevent the deterioration in future financing quality, it is suggested to restrict the rate of growth of banks' financing portfolios by applying 'speed limits', which could be restricted to those types of financing that are perceived to have significant risk for the banks' financing portfolios. Thus, the 'speed limits' need not necessarily be applied to the entire financing portfolio (Honohan, 1997 as quoted by Louzis et al., 2011). It should also lead the regulator (OtoritasJasaKeuangan/OJK) to issue the regulations limiting the exposure of a bank to a single sector of the economy or a narrow geographic region. The over-exposure to certain geographic areas or economic sectors could make a bank vulnerable to weakness in a particular industry or region and this poses a risk. In addition, OJK should also pay close attention to the exposures, focusing on a single exposure and related-party financing in order to reduce or limit credit risk in Islamic banks.

And lastly, the regulatory authorities should focus on the factors affecting credit risk in order to detect banks with potential NPF increases. Moreover, regulator should place emphasis on risk management systems and procedures followed by banks in order to hamper future financial problems.

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