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Revisiting the Role of Bank's Capital, Loan Loss Provisioning and Risky Assets to Credit Risk in Malaysia: An Application of Dynamic Heterogenous Panel Technique

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Abstract

The issue of credit risk among financial institutions has become *de rigueur* matter for many years particularly among risk managers, market players, regulators and academia in Malaysia. The negligence over specific credit risk factors in credit risk management could herald to the balance sheet loss as what happened in the US mortgage prime crisis. This paper is presented primarily to investigate the long run and short run relationship between credit risk and bank specific factors such as capital adequacy(CAR), loan loss provisioning(PROV) and risky assets (RWA) across different types of banks comprising Islamic banks, Islamic banking windows, commercial banks and investment banks in Malaysia. The application of heterogeneous panel model namely Pooled mean group (PMG) will allow for heterogeneity effect across non-homogenous banking operations. From our findings, it is evident that an increase in capital level reduces default problem for Islamic banking windows. Further, we find positive association between RWA and NPL and also between PROV and NPL which implies that loan loss provisioning could be important signal of risk taking behaviour. Besides that, our results also suggest that the nature of credit risk among Islamic banks in Malaysia are still following market force given by the fact that their credit risk management routines still follow the conventional practices.

Keywords: Credit risk; Pooled mean group.

1.Introduction

Credit risk becomes one of the crux areas in the banking institutions. The topic covered is wide ranging, reflecting the concerns of authority bodies in having prudent credit risk management. The Subprime Banking crisis was systematically associated with the credit risk as the net worth of banking system had been eroded by the escalating non-performing loans. In Malaysia, the fundamentals of banking institutions have been supported dominantly by the large scale of government intervention. The Malaysian regulatory incentive in strengthening capital base and operations managed to bring safe atmosphere for banking industry from contagion impact of the US subprime crisis. The role of regulator in setting minimum capital requirement as buffer against risk should undermine the impact of credit risk and produce favourable conditions for banking industry. Apart from the positive role of CAR regulated under Basel III Accord, the excessive optimism by risk taker manager will recklessly resort in risky assets at the cost of shareholder and depositor.

On the other hand, loan loss provision is perceived as a financial tool for accommodating any potential losses from expected loan default within an institution. It is an expense borne by financial institution for allowance of any bad financing. By having clause for loss provisioning, ideally it can provide cushion on bank's solvency in event of default. The pattern of loan loss provisioning is in line with the degree of riskiness of assets being offered to customer. In the same vein, loan provisioning clause is perceived as a signal of risk taking behaviour undertaken by a bank as risk averse bank will allocate small provision and vice versa.

The main objective of this study is to estimate the determinants of credit risk among Malaysian banks by relaxing homogeneity assumption in the short run and the long run coefficients by adopting dynamic heterogenous panel model, i.e., pooled mean group (PMG) introduced by Pesaran *et al.* (1999). The idiosyncratic and uniqueness of banking operations across different types of banks make it is necessary to allow the heterogeneity effect in the estimation. Most literature have been concentrated in modelling the credit risk factors using Ordinary Least Square (OLS) regressions that require dealing with classical assumptions in OLS such as autocorrelation, heteroscedasticity and multicollinearity problem. Furthermore, dynamic regression commonly suffers from endogeneity problem which effectuates to bias in the estimation (Masih and M, 1996). Thus, PMG is conducted specifically to handle heterogeneity and endogeneity bias in dynamic system.

2. Literature Review

2.1. Capital Level

Capital adequacy is perceived as a powerful tool to monitor the behaviour of risk taking incentive by navigating bank to adjust the balance sheet item so that the minimum regulatory capital requirement can be satisfied. Moral hazard theory postulates that banks' low capitalization causing greater number of default problems, Abid *et al.* (2014). This infers that a thinly capitalized bank may suffer greatly from NPL problem. Ahmad and Ariff (2007)

found that capital regulatory control and systematic management of loan's quality were critical factors in influencing the level of loan defaults in emerging economies. According to Dewatripont and Tirole (1994), through recapitalization process, one bank has no choice either to elevate the level of capital (by raising more equity, holding risk weighted asset constant) or to reduce incentive in risky asset portfolio (holding equity capital constant) primarily to maintain the excess over minimum capital requirement. This tradeoff between indulging in risky assets and regulatory constraints fabricates self-regulated system as the capital adequacy clamping the volume of risky portfolio. Antithetically, there were also studies showed the negative spillover effects over the imposition of regulatory capital (Blum, 1999; Rime, 2001). According to Blum (1999) the existence of this regulatory rule had opened space for risk tolerant manager to indulge in risky asset. The rationale for such behaviour lies from the fact that under binding capital constraint, the additional equity is much more valuable despite high floating cost for equity issuance. From the empirical evidence on 154 different types of Swiss banks from 1989 to 1995, via simultaneous equation,(Rime, 2001) found that as bank approaching the capital regulatory benchmark, there was positive relationship between changes in the capital and risk.

In a recent study on panel data consisting of 322 observations from 22 commercial banks over 15 years (2001-2005) in Bangladesh, Zheng *et al.* (2018) concluded that there was an inverse relationship between capital level and credit risk. Parallel finding is also found by Abid *et al.* (2014) who investigated the potential effect of both macroeconomics and bank specific determinants on households' non-performing loans among 16 Tunisian banks over 2003-2012 period. Using System GMM method, they found that low capital banks had higher moral hazard incentive. In a recent study of Waemustafa and Sukri (2015) they examined the impact of regulatory capital to credit risk among 15 Islamic banks and 13 conventional banks in Malaysia from 2000-2010. The study found positive association between capital ratio and credit risk for Islamic banks and negative relationship for conventional banks. They argued that Islamic banks maintain 4 times larger capital requirement than conventional banks and this drives Islamic banks to have higher tendency in engaging in risky sectors.

2.2. Loan loss provision

In theory, loan loss provisioning clause is basically perceived as a barometer that indicates the level of quality of underlying bank's loan portfolio. The provision level is determined by solely historical experience of the institution (Messai and Jouini, 2012). Consequently, high expectation of bank loss in future should be accompanied with high level of loss provision, indicating positive co-movement between PROV and NPL problems (Chaibi and Ftiti, 2015). The decision on provisioning is largely influenced by several factors such the regulations, tax regimes, accounting rules and also by the discretionary changes such income smoothing behaviour, risk assessment and others, (Bikker and Metzemakers, 2002). There are basically three primary objectives for provisioning where the first purpose is for earning smoothing. The second objective for provisioning scheme is to manage capital as loan loss provision also perceived as regulatory capital control. The third motivation for having provisioning is to capture the tax benefits. For Malaysia banking environment, the positive and significant association between loan loss provisioning and credit risk has been shown by Ahmad and Ariff (2007). The positive association between these two items emanated from the degradation of the quality of loans. The study from Fisher *et al.* (2000) also demonstrated identical result for many banks under NAFTA countries. On the other hand, Bikker and Metzemakers (2002) found that the provisioning pattern was related to the business cycle. The provisioning fund would be higher to cater expected risk during the economic downturn.

Chaibi and Ftiti (2015) tested the direct impact of PROV to NPL for 147 French banks and 133 Germany banks by putting reference to the period of 2005-2011. Using dynamic panel data approach, the study found a significant positive relationship between PROV to the NPL of French banks and insignificant relationship found in Germany. Nikolaidou and Vogiazas (2014) investigated the role of PROV to NPL using different approach, i.e., autoregressive distributed lag (ARDL) model over 2001-2010 across Bulgarian banking system. The study concluded that PROV appears to play immaterial role in influencing credit risk in both short run and long run. In a study of credit risk determinants to a sample of 85 banks in Italy, Greece and Spain for the period of 2004-2008, Messai and Jouini (2012) concentrated on the banks that had been affected significantly by the subprime mortgage crisis and the debt crisis. The study found that NPL varied positively with the loan loss reserves, implicating that banks that envisage high earnings would demand higher provisions to maintain short term solvency.

2.3. Risk Weighted Assets

The positive association between risky assets and non-performing loans problem was documented during the Subprime crisis. The tsunami effect of subprime crisis devastated not only real estate value but the capital base of major financial institutions globally. The mortgage originator lent money for those who had bad credit history which logically had higher propensity to default. This phenomenon was supported by healthy economic condition, lower interest rate, capital liquidity and excessive optimism that borrowers could service their debt. Under Malaysian banking industry, the banking industry remained susceptible towards defaulting problems to a lesser degree. This phenomenon happened as result of stringent supervision and regulation by Bank Negara Malaysia towards credit management practice by local and foreign banks. However, large capital buffer could provide extra incentive for banks in resorting in risky asset portfolios. Abdul Wahab *et al.* (2017) found positive relationship between capital ratio and risk-weighted assets across different types of Malaysian banks. This finding infers that high capital growth provides extra cushion for riskier activities.

2.4. An Overview on Banking Sector in Malaysia

As an emerging country, credit risk management practice plays significant role primarily to safeguard the solvency of all banks in Malaysia. All types of banks in Malaysia are subjected to the rules and regulations controlled by the Bank Negara Malaysia. Under Malaysian banking landscape, it consists of four main types of banks with unique operations namely commercial banks, investment banks, Islamic banks and commercial bank with Islamic banking windows. These banks play paramount roles for channelling resources from the household (surplus unit) to the borrowers (deficit unit). On the other hand, investment banks play slightly different role. The major activities for Investment banks will be acting as broker for institutional investors. Besides, investment banks also provide underwriting services by playing role as agents between an issuer of securities and public.

When Bank Islam Malaysia Berhad, the pioneer of Islamic Bank in Malaysia was set up in 1983 during embryonic stage, the bank was operated under the auspice of a new Islamic Banking Act 1983. But as the demand for Islamic financial products soaring, many others conventional banks are following trend in introducing *Shariah* compliant products to the public. The business nature of Islamic bank is quite identical to its conventional counterparts excepting that the bank neither receives interest payment from borrowers nor pays predetermined interest to depositors due to stringent prohibition of *riba*, (Abdul Wahab, 2017). The modus operandi for Islamic banks lies on the unique principle called profit and loss sharing (PLS) paradigm. This PLS upheld under two-tier *mudarabah* model where the assets and liability are integrated. Under the PLS roof, the implementation of sharing principle between the bank and depositor provides virtual disciplinary device that preserves the resilience and stability for both parties from any shock in short term.

3. Methodology

3.1. Data and Variables

The study employs data compiled from the Monthly bulletin statistics of Bank Negara Malaysia for a duration of 128 months commencing from January 2007 till September 2017. The analysis covers four non-homogenous types of banks comprising Islamic banks, Islamic banks windows, commercial banks and investment banks. The estimation of the bank's credit risk will be using non-performing loan (NPL) ratio (3 months non-performing loan over 3 months total loans). The un-systematic credit risk factors are as follows:

a. Risk weighted assets ratio (risk weighted asset over total asset)
b. Loan loss Provisioning (loan loss provision over total asset)
c. Capital adequacy ratio (capital base over total asset)

As risk-weighted asset has been assigned in the model, it is not appropriate to use RWCAR. One remedy to tackle this collinearity problem among the independent variables is by looking for appropriate substitution for capital adequacy *i.e.* by changing the denominator with the total assets instead of risk based assets (Shrieves and Dahl, 1992).

3.2. Model Specifications

The degree of homogeneity for panel analysis can be analysed under 4 critical assumptions with respect to variations of (i) intercept, (ii) residual variance, (iii) short run coefficients and (iv) long run coefficients. Motivated from heterogeneity nature of banking businesses, this study employs pooled mean group (PMG) that relaxes assumptions (i), (ii) and (iii). The routine to estimate PMG will follow (Blackburne and Frank, 2007) via special STATA package command namely *xtpmg*. We can summarize our model as:

$$NPL_{it} = \mu_i + \beta_{1t} CAR_{it} + \beta_{2t} RWA_{it} + \beta_{3t} PROV_{it} + e_{it} \quad (1)$$

Where *i* denotes specific type of bank and *t* represents number of periods t= 1,2,...,128 months. Dynamic model basically includes the lagged term of dependent variable in the right-hand side of the model where this creates a statistical problem called endogeneity bias where regressor is related to error term. Without proper treatment, consequently it produces bias and inconsistent estimates. In order to avoid endogeneity bias flowing from dynamic heterogenous specification, (Pesaran *et al*., 1999) introduced a model called pooled mean group (PMG) which basically proposes the pooling and averaging individual cross sections effect under error correction framework. PMG specification effectively eliminates endogeneity bias through error correction re-parameterization. By taking reference to model (1), variables in model (1) will be re-parameterized into the auto-regressive distributed lags ARDL(1,1,1,1) as:

$$NPL_{it} = \mu_i + \lambda_i NPL_{i,t-1} + (\beta_{10t} CAR_{it} + \beta_{11t} CAR_{i,t-1}) + (\beta_{20t} RWA_{it} + \beta_{21t} RWA_{i,t-1}) + (\beta_{30t} PROV_{it} + \beta_{31t} PROV_{it-1}) + e_{it} \quad (2)$$

By setting changes (triangular sign) to the NPL, model (2) becomes

$$\Delta NPL_{it} = \mu_i + (\lambda_i - 1) NPL_{i,t-1} + (\beta_{10t} CAR_{it} + \beta_{11t} CAR_{i,t-1}) + (\beta_{20t} RWA_{it} + \beta_{21t} RWA_{i,t-1}) + (\beta_{30t} PROV_{it} + \beta_{31t} PROV_{it-1}) + e_{it} \quad (3)$$

Then, each coefficient of the RHS variables are normalized by (λ_i-1) or -(1-λ_i) since λ_i<1, let Φ_i = -(1-λ_i):

$$\theta_{0i} = \frac{\mu_i}{1-\lambda_i} \quad \theta_{1i} = \frac{\beta_{10i} + \beta_{11i}}{1-\lambda_i} \quad \theta_{2i} = \frac{\beta_{20i} + \beta_{21i}}{1-\lambda_i} \quad \theta_{3i} = \frac{\beta_{30i} + \beta_{31i}}{1-\lambda_i}$$

Then, the error correction reparameterization of (3) becomes:

$$\Delta NPL_{it} = \mu_i + \phi_i (NPL_{i,t-1} - \theta_{0i} - \theta_{1i} CAR_{it} - \theta_{2i} RWA_{it} - \theta_{3i} PROV_{it}) + \beta_{11t} \Delta CAR_{it} + \beta_{21t} \Delta RWA_{it} + \beta_{31t} \Delta PROV_{it} + e_{it} \quad (4)$$

From model (4), the highlight will be the long run coefficients as they provide theoretical information on the elasticities for each credit risk factor across different types of banks. Besides that, error correction term, Φ_i in

equation (4) offers period of speed adjustment to measure how long it takes for the short run shock to return to the long run equilibrium. The fastest speed adjustment indicates better mean reversion process. Under normal circumstance, it is economically sensible to see deviation of the short run coefficients from the long run coefficients due to several factors including sudden economic shock, policy regime switch, political shift, trade war and others. However, under cointegrated relationship, the short run dynamics is temporary in nature and will eventually approach to the long run equilibrium.

4. Results

The pooled mean group estimation allows intercept and short run coefficients to vary across panels as shown in Table 1. The first one, the error correction coefficient, Φ_i is found to be statistically significant at 5% level and implies the existence of long run equilibrium. In other words, through error correction term, it indicates that the CAR, RWA and Provisioning do, as component of the long term cointegrating relationship through the lagged error correction term, jointly influence the level of NPL. The value of coefficient Φ_i= 0.05 implies that the period needed for the short run dynamics to go back to long run equilibrium will take approximately twenty periods. In other words, when there is displacement from the long run equilibrium, the system will take just over 20 months (for monthly data) to restore a new equilibrium. This finding alludes that any shock in short time period will affect the short run estimate but tends to be 'normalized' to the theoretical equality after one year. From the long run relationships, the coefficient of RWA and PROV are found to be statistically significant at 5% significant level while the capital level is found to be insignificant.

The positive sign of RWA coefficient is parallel with the finding by Shrieves and Dahl (1992). The positive beta of long run RWA coefficient portrays that one unit increase for investment in risky asset will increase the level of credit risk by 187% in the long run. This positive association between the risk-taking behaviour and credit risk meets theoretical expectation as optimistic banks would favour more in risky lending and this potentially elevates the degree of non-performing loans.

Table-1. PMG estimates for bank specific determinants of credit risk

Variable	Coefficent	z-value	Prob
(long run)			
RWA_{it}	1.8712	3.35	0.0010***
CAR_{it}	-0.7229	-1.28	0.2020
$PROV_{it}$	0.0745	3.97	0.0000***
(Short run dynamic)			
$ECT(\Phi_i)$	0.0509	2.44	0.0150**
ΔRWA_{it}	0.1406	1.00	0.3190
ΔCAR_{it}	-0.2041	-1.44	0.1510
$\Delta PROV_{it}$	0.0582	2.94	0.0030***
Intercepti (θ_{0i})	0.0341	2.19	0.0280**

Dependant variable: ΔNPL_t ; *, **, *** Significant at 10%, 5% and 1% level

The coefficient for capital adequacy ratio (CAR) is found to be negative and statistically not significant at 5% level. Despite of insignificant relationship between capital level and non-performing loan, its sign meets theoretical expectation. In Malaysia scenario, most Malaysian banks satisfy the minimum capital adequacy requirement of 8% plus 2.5% capital conservation buffer following the guideline of Bank Negara Malaysia as well as the Basel III framework. From our observation, all banks meet the minimum requirement and their capital is enormously large relative to the portion of risky financing assets. But as capital adequacy ratio increases, our hypothesis that the capital adequacy will be able to control non-performing loan problem remains vague. For loan loss provisioning, it is expected to be positively related with credit risk. The result shows positive coefficient for provision and statistically significant at 5% level. This satisfies our expectation that provisioning signals risk taking behaviour, implying greater default problems.

From Table 2, there are variations of coefficient for short run dynamic for each type of banks. In a brief, we can see almost all types of banks exhibit the insignificant short run coefficients at 5% significance level, excepting Loan Loss provision. This deviation of short run bank specific credit risk factors from the long run equilibrium regarded as normal phenomenon lies on the fact that the modus operandi for each type of banks is different from each other. Furthermore, from Table 2, we can see that the coefficients for error correction terms are found to be statistically significant at 10% for Full-fledged Islamic banks, Islamic banking windows and commercial banks. This shows us that the heterogeneity feature for short run changes from these banks is temporary in nature and mean reversion process takes place with different speeds of adjustment. By having Φ_i=0.1099, we can see that Islamic banking window will be adjusted to long run equilibrium at faster speed with 9 months period compared to other types of banks (i.e Islamic banks approximately 49 months while commercial banks need at least 47 months). In contrast, the investment banks do not show the significance of the error correction term coefficient driven from the fact that its nature of business is substantially different from commercial banks.

Table-2. PMG estimates for bank specific determinants of credit risk for each type of banks.

Variable	Islamic banks	Islamic Bank Windows	Commercial Banks	Investment banks
(Iong run)				
RWAit	1.8712			
	*(0.0010)****			
CARit	-0.7229			
	(0.2020)			
PROVit	0.0745			
	*(0.0000)****			
(Short run dynamic)				
ECT(φi)	0.0204	0.1099	0.0221	0.0513
	*(0.0710)**	*(0.0010)***	*(0.0920)**	*(0.1020)*
ΔRWAit	-0.0138	0.5574	-0.0495	0.0684
	(0.9450)	*(0.0410)***	*(0.6450)*	*(0.7450)*
ΔCARit	0.0432	-0.4587	0.0409	-0.4419
	(0.7760)	*(0.0320)***	*(0.5740)*	*(0.0330)***
ΔPROVit	0.0318	0.0543	0.0313	0.1153
	*(0.0000)****	*(0.0000)****	*(0.0000)****	*(0.0000)****
Intercepti (θ_{0i})	0.0130	0.0791	0.0133	0.0311
	(0.4490)	*(0.2950)*	*(0.5110)*	*(0.4250)*

Dependant variable: ΔNPL_t ; Second row parenthesis refers to the *p-value* of Z-statistics
*, **, *** Significant at 10%, 5% and 1% level

It is quite unique to observe that Islamic banks and Islamic banking window showing convergence to the long run equilibrium and behaving the same way like conventional banks (at 10% significance level). Despite that the regulatory body of Malaysia treats Islamic banks in different ways through establishment of the Islamic Financial Services Act in 2013, it seems that the regulation on the capital adequacy and loan loss provisioning on the Islamic banks is still identical with their conventional counterparts. One might see that the Islamic banking windows (IBW) follow the long run equilibria given by the fact that the host for the IBW still under the patron of conventional system.

5. Conclusions

The main objective of this study is to examine the long run and the short run dynamics of credit risk factors from three major sources such as loan loss provisioning, capital adequacy and asset riskiness with the application on the monthly data of mixed Malaysian banking systems. From PMG specification, we found that most explanatory variables are significant with positive relationship between loan loss provisioning and non-performing loan (NPL) problem with 7% slope and between RWA and NPL with more than 100% elasticities. The positive relationship between credit risk and risky assets is economically sensible and meets our priori expectation. Loan loss provisioning contrasts with theoretical expectation, implying that provisioning provides signal for risk taking behaviour. On the other hand, we found insignificant role of capital adequacy in reducing non-performing loan problem. By looking on each category of bank, we found that all banks displayed the convergence from the short run to long run equilibrium excepting Investment banks, supported by distinct nature of investment banking operations. Moreover, there is evidence that Islamic banking windows show effectiveness of capital adequacy in reducing non-performing problem. This finding invalidates moral hazard hypothesis that postulates small banks have greater tendency to resort in risky assets. Furthermore, Islamic banking windows could leverage on the advantages of its parent commercial banks who have strong fundamental in terms of their operations and assets. It seems that its risk management operations still follow the same practice of its parent firms. For future study, it may be worth of exploring the credit risk determinants of individual Islamic banks and looking on the impact of dual-banking system to non-performing loan.

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