# BANK EFFICIENCY, RISK EXPOSURES AND GLOBAL ECONOMIC CRISIS: A THEORETICAL FRAMEWORK

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# ABSTRACT

This study attempts to review literatures on bank risk exposures, bank efficiencies and global economic crisis. The findings show that there are three novelties that can be worked as follow: 1) in terms of the bank efficiency measure; 2) in terms of the relationship between bank efficiency and six different types of risk exposures; 3) in terms of examining the impact of global financial crisis on the East Asia region. Keyword: bank efficiency; risk exposures

# **INTRODUCTION**

Risk management has been a subject that received much attention in the banking literature since the mid 1980's. Indeed, the recurring financial crisis has heightened intention in this subject. When discussing the risk management, one cannot avoid four steps involved in the process; namely, 1) risk identification, 2) risk quantification, 3) risk monitoring and mitigating, and 4) risk reporting. While the role in risk reporting is being played by bankers and policy makers, there is a limited study on identifying, quantifying, and monitoring risk.

In measuring various types of risk exposures, the financial ratio approach as well as the Capital Asset Pricing Model (CAPM, hereafter) are frequently employed. For the former, the insolvency risk index (Zrisk index, hereafter) is used to examine the overall perceived risk of banks. (Hannan and Hanweck (1988), Liang and Savage (1990), Eisenbeis and Kwast (1991), Sinkey and Nash (1993), Nash and Sinkey (1997), Blasko and Sinkey Jr. (2006), and Ahmad et al. (2006)). For the CAPM approach, several research such as Hahm and Mishkin (2000), Chamberlain and Popper (1997), Bodnar and Gentry (1993), Akella and Greenbaum (1992), Choi and Kopecky (1992), Bae (1990), Brooth and Officer (1985), Flannery and James (1984), and Lynge and Zumwalt (1980) show that banks are exposed to market risk, interest rate risk, foreign exchange rate risks, total risk, and unsystematic risk.

Normally, discussions for factors affecting bank risk fall in two extremes; namely, the risk measures and determinants of risks.

### **RISK MEASURES**

The general techniques to measure risk exposures can be classified into three; 1) the CAPM, 2) the market information, and 3) the financial ratio approach. Saunders et al (1990) apply a two-factor CAPM by looking at the market and interest rate risk exposures of the United States bank holding companies (BHCs). In another study, Gallo et al (1996) adopt a single-factor CAPM by focusing only on the systematic and unsystematic risk exposures without investigating the total risk exposure. Anderson and Fraser (2000) also employ a single-factor CAPM in examining total, systematic, and unsystematic risk exposures; they define systematic risk exposures by the difference between total risk and unsystematic risk rather using beta coefficient of the stock market index.

Hassan (1993) constructs two risk measures based on a single-factor CAPM and three risk measures using market information approach. In another study using market information approach, Madura et al (1994) construct an implied risk measure in examining the determinants of ex-ante risk. Their implied risk is formulated based on call option prices, following Latane and Rendleman (1976). Ahmad and Ariff (2003) develop three risk measures using a single-factor CAPM and one risk measure based on market information approach in examining the risk determinants for the case of Malaysian deposit-taking institutions.

Persidangan Kebangsaan Ekonomi Malaysia ke V (PERKEM V), Inovasi dan Pertumbuhan Ekonomi, Port Dickson, Negeri Sembilan, 15 – 17 Oktober 2010 Konishi and Yasuda and Yasuda et al (2004) improve the CAPM risk measures by Ahmad and Ariff (2003) by developing five risk measures based on a two-factor CAPM plus a risk index based on market information approach and they adopt the Z-score index developed by Boyd et al (1993) to evaluate the insolvency risk exposure. Gonzales (2004) employs one market information plus one financial ratios risk measures to examine total and credit risk exposures of financial institutions. On the other hand, Cebeyonan and Strahan (2004) conduct four risk measures which are solely based on financial ratios. Blasko and Sinkey Jr (2005) also analyze risk exposures based on financial ratio approach. However they apply the insolvency risk index (Zrisk Index) rather the standard deviation of the accounting ratios. Zrisk Index has been widely used by many studies such as Liang and Savage (1990), Eisenbeis and Kwast (1991), Sinkey and Nash (1993) and Nash and Sinkey (1997) and Rubi et al (2006) as a proxy to bank insolvency risk.

Based on previous discussions, there is a lack of studies on Islamic and conventional banks in terms of risk measurements using three-factor CAPM as well as the Zrisk index. In particular, the CAPM risk exposures studied by Saunders et al (1990) and Konishi and Yasuda and Yasuda et.al (2004) is only a two-factor CAPM. A three-factor CAPM study would enrich the literature. The three macroeconomic factors for the CAPM approach that will be covered in this study are the stock market index, interest rate, and foreign exchange rate. Chamberlain et.al. (1997) and Hahm (2004) highlighted exchange rate, among other two well known factors namely stock market and interest rates which could influence the value of banking institutions. Moreover, both previous studies focus on developed countries, the United States and Japan, there is no study focusing on both developing countries, and Islamic and conventional banks. Finally only the three-factor CAPM risk measures have been focused.

# **RISK DETERMINANTS**

Recent studies have not only examined the determinants of bank risk in general, but also analyzed the impact of a specific factor on risk along with bank-specific-variables as the control variables. Most studies on factors affecting bank risk have been conducted on the United States, the European countries as well as the Japanese markets, which definitely focus on the conventional banks. Only one study has been conducted for the Malaysian markets; but it emphasizes on the deposit-taking institutions, not the banking institutions per se. There is a lack of study investigating the risk determinants for the case of both Islamic and conventional banks.

Madura et al (1994) examine the determinants of the ex-ante risk of financial institutions in the United States by analyzing nine bank specific factors. Ahmad and Ariff (2003) investigate factors affecting risks for the case of Malaysia using the CAPM and market information approach by fourteen risk related variables against three risk measures based on a single-factor CAPM and one risk measure based on market information approach.

In contrast to the above studies, Saunders et al. (1990) examine the relationship between ownership structure and the U.S. bank risk exposures by taking into account three bank specific variables in their multiple regression models. Anderson and Fraser (2000) adopt similar ownership variables as Saunders et al (1990); but they apply a slightly different specification for the control variables as well as the risk measurements. Konishi and Yasuda (2004) examine the same issue but for the case of Japan also they improve the risk measurements and add in one capital related variable by adopting a two-factor CAPM and Z-score risk index as well as analyzing the capital adequacy standard, respectively. For the case of Spanish banks, Marco and Fernandez (2008) employ three bank-specific variables. Studying bank governance across many countries, Laeven and Levine (2009) and Angkinand and Wihlborg (2009) incorporated both bank-specific variables and country-specific variables as control variables. Hassan (1993) investigates the impact of loan sales on bank risks, accompanied with six bank specific variables for the United States. Cebenoyan and Strahan (2004) apply only four bank-specific variables. Examining the impact of derivative activities on Asia-Pacific banks' interest rate and exchange rate risk exposure, Yong, Faff, and Chalmers (2009) employ seven bank-specific variables

Analyzing the impact of regulatory restriction on bank risk-taking, Gonzales (2004) develops nine regulatory variables along with three bank-specific variables and his findings show that all control variables are positively related to total risk exposure.

Looking into the effect of income structure on credit risk of European banks, Lepetit, Nys, Rous and Tarazi (2008) employ five bank-specific variables Studying five accounting risk and three market risk measure using single-CAPM.

With regards to the impact of foreign-owned banks on bank liquidity risk across ten European emerging economies, Dinger (2009) adopts three bank-specific variables and four country-specific variables.

# **EFFICIENCY MEASURES**

In the earlier cross-country studies, it was not unusual to estimate separate frontier for different countries, but the recent trend is to estimate a common frontier for multiple countries (e.g., Bonin, Hasan, & Wachtel, 2005; Carvallo & Kasman, 2005). Most earlier cross-country studies have been done on the European countries (e.g., Altunbas & Chakravarty, 1998; Carbo, Gardener, & Williams, 2003) but have now spread to other regions such as transition countries (e.g., Bonin et al., 2005; Kasman, 2005), Latin American and the Caribbean (e.g., Carvallo & Kasman, 2005), developing countries (e.g., Boubakri, Cosset, Fischer, & Guedhami, 2005) and Asian countries (Williams & Nguyen, 2005). While the joining of Central and Eastern European countries into the European Union (EU) becomes a new motivation for efficiency studies on these countries (e.g., Kasman & Yildirim, 2006), the increasing number of countries operating Islamic banking has raised interest on measuring their performance (Yudistira, 2004) and in comparison with conventional banks in single and multiple countries (e.g., Al-Jarrah & Molyneux, 2005; Alpay & Hassan, 2006). Therefore, environmental factors such as country differences and banking types play some role in measuring bank efficiency and may have some effects on the estimated efficiency.

Cross-country bank efficiency studies can be generalised into those who do control for countryspecific factors in frontier estimation Maudos & De Guevara, (2007); Williams & Nguyen, (2005); Kasman (2005); Bonin, et al.(2005); Chaffai, Dietsch, and Lozano-Vivas (2001) and Dietsch & Lozano-Vivas, (2000) and those who do not Abd Karim, (2001); Al-Jarrah & Molyneux, (2005) and Alshammari, (2003).

# **Controlling for Country-specific Factors in Cross-country Studies:**

The studies that have controlled for the country-specific factors can be divided into three categories. The "one-step" procedure, they simultaneously assume inefficiency distributions to be directly influenced by bank-specific factors (e.g., Williams & Nguyen, 2005); the "one-step" procedure and they further correlate the inefficiency scores using OLS regression with factors such as public ownership, market concentration (deposits), equity capital (Fries & Taci, 2005) and foreign ownership (Bonin et al., 2005). The "two-steps" procedure (e.g., (Dietsch & Lozano-Vivas, 2000) and (Carvallo and Kasman (2005),

#### Without Controlling for Country-specific Factors in Cross-country Studies:

Cross-country bank efficiency studies that do not control for country-specific factors can be grouped into two, based on the procedures to determine factors influencing inefficiency. The first category employs Battese and Coelli's (1995) model using the "one-step" procedure (Kasman & Yildirim, 2006), bank types dummy variables (Abd Karim, 2001), ownership, size (Abd Karim, 2001), assets, liquidity and concentration ratio (Al-Jarrah & Molyneux, 2005) to directly influence inefficiency.

In the other category, without controlling for any country-specific factors in a common frontier, these studies (e.g., Allen & Rai, 1996; Maudos, Pastor, Pérez, & Quesada, 2002) have employed the resulted efficiency scores and correlate them with bank-specific factors such as ownership (Weill, 2002), organisational structure (Boubakri et al., 2005), bank size, specialisation, profitability and risk factors (Maudos et al., 2002) using the OLS regression "two-steps" procedure. The efficiency of banks has been proved to improve with loan-to-asset ratio, concentration ratio, risk, and GDP growth rate but deteriorate with network density (Maudos et al., 2002). Furthermore, the efficiency of Islamic banks in most countries improves with size and profitability (Hassan, 2003, 2005).

# Equity and Bank Output Quality in Cross-country Studies:

Besides country-specific factors, equity and bank output quality have frequently been controlled in frontier estimation of cross-country studies. Equity which is an alternative to deposits in financing bank operations has either been controlled in frontier estimation as fully exogenous (Bos & Schmiedel, 2007; Carvallo & Kasman, 2005), netput (fully interactive with input and output variables) (Kasman & Yildirim, 2006; Maudos et al., 2002) or to proxy bank regulations in the form of equity-to-assets ratio (Dietsch & Lozano-

Vivas, 2000; Kasman, 2005). On the other hand, bank output quality has either been controlled as fully exogenous (Fries & Taci, 2005) or as netput (Alshammari, 2003).

## **Costs, Profit and Output Distance Functions in Cross-country Studies:**

In cross-country bank efficiency studies, while cost function has frequently been employed (Fries & Taci, 2005; Maudos & De Guevara, 2007), increasing studies have employed both cost and profit functions (Al-Jarrah & Molyneux, 2005; Bos & Schmiedel, 2007). However, a very limited study has used output distance function (Rezitis, 2007) and its employment is mainly to analyse bank productivity despite its advantages of not requiring input price information subsequently avoiding distorted and inaccurate estimates. Furthermore, it does not require any behavioural assumption.

### **GLOBAL FINANCIAL CRISIS**

Global financial crisis originated in the United States starting 2006 and 2007 due to the subprime mortgage crisis (Demyanyk and Hasan (2009). The word 'subprime' is usually defined as a riskier loan than a regular loan from the perspective of lenders. It is riskier in the sense that it has higher expected probability of default. Several authors have suggested the causes of the U.S subprime crisis. Among others, Demyanyk (2008) empirically showed that the borrowers who applied subprime loan were temporary borrowers who speculate on real estate prices or want to improve their credit history. He found that 80% of borrowers either defaulted on loans or prepaid (sold their assets or refinance) within the first three years of loan tenure. On the other hand, Keys et al. (2008) and Mian Sufi (2008) showed that securitization is one of the causes of the increased in subprime lending. He argued that securitization reduces the need for banks to screen borrowers, thus increases default. In contrast to Demyanyk (2008), Keys et al. (2008) and Mian and Sufi (2008), Taylor (2008) transferred the guilt to the lax monetary policy. He blamed the low interest rates between 2002 and 2004 for the housing boom, followed by the subprime mortgage collapse.

# CONCLUSIONS AND DISCUSSIONS

From the previous discussion, it can be concluded that the Zrisk index, market risk, interest rate risk, exchange rate risk, total risk, and unsystematic risk can be estimated using the equation as follow :

$$Z_{it} = \alpha_i + \beta EFF_{it} + \gamma x_{it} + \delta Y_{it} + \Omega GFC_{it} + \epsilon_{it} \qquad (1)$$

EFF is a measure of bank efficiency using SFA method, X is a vector of bank-specific or micro variables, Y is a vector of macroeconomic variables, GFC is a dummy variable to control for global financial crisis (2008 and 2009 = 1, otherwise = 0),  $\alpha_i$  is an individual-specific intercept,  $\beta$ ,  $\gamma$  and  $\delta$  are slope coefficients to be estimated.

This study adopts a three-factor CAPM introduced by Chamberlain et.al (1997) and Hahm (2004), which was initially developed by Sharpe (1964). The risk-return relationship of the three-factor CAPM can be expressed as follows:

$$\mathbf{R}_{t} = \alpha + \beta_{m}(\mathbf{R}_{m}) + \beta_{i}(\mathbf{R}_{i}) + \beta_{\text{forex}}(\mathbf{R}_{\text{forex}}) + \varepsilon_{t}$$
(2)

Where:

R <sub>t</sub>	= return of bank during period of t,
$\beta_{m}$	= beta coefficient measuring the sensitivity of bank portfolio return to market return
$\beta_i$	= beta coefficient measuring the sensitivity of bank portfolio return to interest rate changes,
$\beta_{forex}$	= beta coefficient measuring the sensitivity of bank portfolio return to exchange rate
	changes
R <sub>m</sub>	= market return from t-1 to t,
Ri	= interest rate changes from t-1 to t,
R <sub>forex</sub>	= foreign exchange rate changes from t-1 to t,
ε <sub>t</sub>	= the error term which captures bank's specific effects
$\alpha_j$	= the intercept of the characteristic line.

From the above equation, five yearly risk measures for each bank can be estimated:

- a) Market risk exposures ( $\beta_m$ )
- b) Interest rate risk exposures ( $\beta_i$ ).
- c) Exchange rate risk exposures ( $\beta$  forex)
- d) Unsystematic risk exposures (standard deviation of  $\epsilon_t$ )
- e) Total risk exposures (standard deviation of R<sub>t</sub>)

The Zrisk Index was developed by Hannan and Hanweck (1988). This index has been widely employed by various banking researchers such as Liang & Savage (1990), Eisenbeis & Kwast (1991), Sinkey & Nash (1993), Nash & Sinkey (1997), Blasco & Sinkey Jr. (2005), and Ahmad et.al (2005). The empirical form of Zrisk index is expressed as follows:

$$Zrisk = \frac{[E(ROA) + CAP]}{\sigma_{ROA}}$$
(3)

A lower Zrisk index implies a riskier bank while a higher Zrisk implies a safer bank.

In terms of efficiency estimation, following Fare and Primont (1995) and Cuesta and Orea (2002), and also allowing for exogenous factors, the general form of a stochastic output distance function can be shown as:

$$1 = D_o(Y_{n,t}, X_{n,t}, Z_{n,t}, \beta) h(\varepsilon_{n,t})$$
(4)

where,  $h(\varepsilon_{n,t}) = \exp(u_{n,t} + v_{n,t})$ , Y<sub>n,t</sub> is a vector of outputs, X<sub>n,t</sub> is an input vector, Z<sub>n,t</sub> is an exogenous factor vector and  $\beta$  is a vector of parameters. Inefficiency is accommodated in the specification of h(.), as  $\varepsilon_{n,t}$  is a composed error term comprised of  $v_{n,t}$  which represents random uncontrollable error that affects the n<sup>th</sup> firm at time t, and  $u_{n,t}$  is assumed to be attributable to technical inefficiency.

Dietsch and Lozano-Vivas (2000) argue that neglecting country-specific variables leads to misspecification of the common frontier and overestimates inefficiency. Thus, most previous studies have controlled for country-specific variables (e.g., Maudos & De Guevara, 2007) or country dummy variables (e.g., Bonin et al., 2005).

Furthermore, certain studies have allowed exogenous factors to directly influence inefficiency effects by including country dummies, bank organisational structure controls such as an Islamic bank dummy (Al-Jarrah & Molyneux, 2005), assets, liquidity and concentration ratios (Al-Jarrah & Molyneux, 2005). Besides including country-specific variables in the estimated function, Williams and Nguyen (2005) and Abdul-Majid, Saal, & Battisti (Forthcoming) also use the Battese and Coelli (1995)'s inefficiency effects model. In the current model, the authors have followed the recent practice of controlling for differences in economic and regulatory environments between countries that may explain differences in efficiency, by including country-specific variables directly in the distance function.

As controlled variables, both microeconomic variables (MIV) and macroeconomic variables (MAV) are used. The MIV are bank specific factors:

1. Loan expansion, ratio of total loan to total asset (TL): researchers seem to have a consensus view that loan expansion is positively related to risk with various reasoning. Hassan (1993) argues that heavy reliance on loans by commercial banks is considered as having a high degree of financial leverage; thus increases the bank financial risk. Looking from a perspective of probability of default, Madura et al. (1994) highlight that giving loans is more risky than holding investment in securities since banks are allowed to invest only in good investment grade securities. This infers that increasing loan as oppose to investment securities leads to a higher risk. On the other hand, Gallo et al. (1996) justify that loans are relatively illiquid, besides subject to default risk. They believe that both liquidity and default issues are the rationale for a positive relationship between loan expansion and risk.

2. Loan quality, ratio of loan loss provision to total asset (PLL): earlier studies hypothesize that provision for loan loss (PLL) represents the probability of future default. Hence, it expected to be positively related to bank risk exposure. For the case of financial leverage, total equity is perceived to provide buffer against loss.

4. GAP measure, absolute ratio of (total market sensitive asset minus total market sensitive liability) to total asset (AGAP): it is well acknowledged that a positive GAP indicates that a particular bank is an asset sensitive bank while a negative GAP indicates that it is a liability sensitive bank. A positive GAP bank (or an asset sensitive bank) is exposed to risk that interest rate will fall whereas a negative GAP bank (or a liability bank) is exposed to risk that interest rate will increase. Thus, the greater the absolute value of GAP, the more the bank is exposed to changes in interest rate. Besides, the mismatch of RSA (rate sensitive asset) and RSL (rate sensitive liability) is subject to bank insolvency since bank share price is influenced by movements in interest rates. Thus, this study hypothesizes that AGAP is positively related to bank risk exposure.

Despite the GAP ratio analysis, Madura et al. (1994) argue that bank risk depends on the proportion of funds obtained in the deposit account (proxied by interest expense), which does not capture in the GAP analysis.

5. Cost of capital, ratio of interest expense to total asset (INTEXP): They underline that the higher the deposit, the higher the interest expense, the higher the volatility of net interest income, thus the riskier is the bank. Therefore, this study hypothesizes a positive relationship between interest expense and risk exposure.

6. Liquid asset, ratio of short term investment securities to total asset (INV): risk is linked to it from the perspective of deposit withdrawal. As it is well noted that having cash ideal is an opportunity cost to banks, banks usually hold investment securities to standby the need for extraordinary deposit withdrawal. Several studies hypothesize that all investment variables should be negatively related to risk due to several justifications. First, banks are restricted to hold only good investment grade securities. Second, net fed fund sellers (buyers) are exposed to a lower (higher) risk due to a lower (higher) liquidity risk. Third, some banks manage the mutual fund assets for their clients to earn advisory fees. In terms of the risk-taking, mutual fund shareholders are the one who bare the market risk, not banks. Hence, from the eye of bankers, mutual fund asset should be negatively related to risk. Fourth, based on maturity mismatch hypothesis, interest rate risk exposure is negatively related to the average maturity of asset, implying that the higher the level of short term asset, the lower will be the liquidity risk. Taking into account of the rationales from past research, this study anticipates that liquid asset is negatively related to bank risk exposure.

7. Size, logarithm of total asset (LTA): majority authors argue that the greater the size, the greater will be the potential to diversify business risk from various perspectives. For instance, Saunders et al. (1990) mention that the larger the bank, the more information is likely to be gathered, thus reducing information risk. They also believe that regulators are unwilling to let big banks fail, hence big banks are synonymous with low risk. In a similar vein, Hassan (1993) justifies that banks with larger assets are more able to diversify; but instead of looking at information risk, he focuses on operating risk that is associated with product or market lines. He believes that larger banks are more able to utilize personnel skill, particularly when engaging in off-balance sheet activities. From a different point of view, Anderson and Fraser (2000) believe that bigger banks are more flexible to adjust unexpected liquidity and capital shortfall. Thus if loan composition is the same but differ only in term of asset size, bigger banks should have lower risk as compared to smaller banks, conjecturing an inverse relationship between size and risk. However, if the loan portfolio composition is different, the big banks overall risk might be higher than the smaller ones. According to them, this is due to the fact that big banks have a tendency to hold riskier loan or to embark in off-balance sheet activities, thus leading to a higher overall risk. Similarly, Gonzales (2004) points out that with the existence of the economy of scale, increase market power, and the 'too big to fail' policy for big banks, big banks tend to enter into risky activities, which suggests a positive relationship between the two. Having said this, it is expected that size could be either positive or negatively related to bank risk exposure.

8. Deviation from traditional banking activity, ratio of non-interest income to total asset (NONII): one way to reduce bank business risk is by diversifying from its intermediation role. The degree of banks' involvement in non-traditional activities can be measured by non-interest income as it incorporates income from fee-based transaction, investment in financial assets, and income other than financing facilities. Previous research points out that the higher the non-interest income, the more diversified the bank is, thus the lesser the business risk. Following the previous findings, this study expects an inverse relationship between non-interest income and bank risk exposure.

The inclusion of these variables is motivated by the works of Saunders et al. (1990), Hassan (1993), Madura et al. (1996), Gallo et al. (1996), Angbazo (1997), Anderson and Fraser (2000), Gonzales (2004) and Ahmad and Ariff (2004) and Abdul Rahman et al. (2008a, 2008b).

The MAV (macroeconomic variables) are:

1. Real growth of gross domestic product (GDP), yield of 10 year-Malaysian government securities minus 3 month treasury bills (SPRD): GDP and SPRD represent the business cycle. For the macroeconomic variables, similar to Koopman et al. (2009), I distinguish three blocks of macroeconomic variables that represent 1) economic cycle, bank-lending condition, and financial market condition. The business cycle block contains gross domestic product growth (GDP) and term spread (SPRD). According to Koopman et al. (2009), Bangia et al. (2002), Kavvathas (2001), and Nickell et al. (2000), GDP and SPRD have a record for predicting default rate variation over stages of the business cycle. As a signal of current economic condition, I expect that both to be inversely related to risk exposure.

CPI, M3, and OVR represent the bank lending condition and for the bank lending condition, I will include the growth rate of inflation (CPI), money supply (M3), and interbank overnight rate (OVR).

2. Broad money (M3): According to Koopman et al. (2009), Blank et al. (2009) and Mannasoo & Mayes (2009), aggregate money supply can either directly or indirectly affect monetary policy and private demand for credit. They hypothesize that lower money supply reduces credit supply by banks, and leads to higher default intensities. Hence, we expect M3 to be negatively related to risk. Also, higher inflation and overnight rate are associated to higher interest rate, causing more expensive for firms to take fresh credit, which may end up to higher default rates.

3. Consumer price index (CPI), Kuala Lumpur interbank overnight rate (OVR): I expect that CPI and OVR to be positively related to risk.

4. Kuala Lumpur Composite index (KLCI): KLCI represents the stock market condition. For the financial market condition, Koopman et al. (2009) opine that stock market return is a good predictor for output growth, thus, I expect KLCI is negatively related to risk exposure.

The choice of variables is closest in spirit to Bangia et al. (2002), Kavvathas (2001), and Nickell et al. (2000), Blank et al. (2009) Mannasoo & Mayes (2009), and Koopman et al. (2009). In order to investigate the global financial crisis or the systemic risk, the approach by Kunt et al. (2006) can be applied. They consider the crisis is systemic if non-performing loans reached at least 10% of total loans or the cost of cleanup operations was at least 2% of GDP.

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