Impact of Interest Margin, Market Power and Diversification Strategy on Banking Stability: Evidence from ASEAN-4

Yosman Bustaman[*], Irwan Adi Ekaputra, Zaäfri A. Husodo and Ruslan Prijadi

ABSTRACT

Manuscript type: Research Paper

Research aims: This study aims to examine the impact of interest margin, market power and banking diversification strategy in products and loan portfolios on banking stability in the ASEAN-4 countries (Indonesia, Malaysia, Thailand and the Philippines).

Design/ Methodology/ Approach: The long-term equilibrium is examined with the random effect panel data regression model while the short-term dynamic relationship between the variables is examined through the dynamic panel data regression model, System Generalized Method of Moment (GMM).

Research findings: After controlling foreign bank penetration, bank-specific variables and macroeconomic variables, this study finds that the intermediary activities which generate interest margins remain as a dominating factor that promotes banking stability in ASEAN-4. This study also finds pure fee-based income products can help banks to reduce instability although an increase in trading activities tend to reduce stability. Additionally, focused-banks which channel special

* Corresponding Author: Yosman Bustaman is a senior lecturer at the Department of Accounting, Faculty of Business Administration and Humanities, Swiss German University, The Prominence Tower, Jalan Jalur Sutera Barat Kav 15, Alam Sutera, Kota Tangerang, Banten 15143, Indonesia. Email: yosman.bustaman@sgu.ac.id.

Irwan Adi Ekaputra is an associate professor at the Department of Management, Faculty of Economics and Business, Universitas Indonesia, Depok, Indonesia. Email: irwan.adi@ui.ac.id.

Zaafri A. Husodo is a senior lecturer at Department of Management, Faculty of Economics and Business, Universitas Indonesia, Depok, Indonesia. Email: z.husodo@ui.ac.id.

Ruslan Prijadi is an associate professor at Department of Management, Faculty of Economics and Business, Universitas Indonesia, Depok, Indonesia. Email: ruslan.prijadi@ui.ac.id.

types of loans may charge a higher margin thereby, lowering the banks' probability of default. An increase in market power, as an impact on banking consolidation, increases banking stability. This finding is consistent with the "competition fragility" hypothesis. However, this is unable to support the non-linear relationship between competition and banking stability.

Theoretical contributions/ Originality: This study contributes to literature by examining the combined effect of interest margin, market power and revenue and loan portfolio diversification on banking stability in ASEAN-4

Practitioner/ Policy implications: Product diversification increases banking stability but banks need to exercise a prudent approach in executing trading activities. The lack of expertise in these activities will increase banking instability. Regulators should scrutinise the cartel-formation behaviour of larger banks so as to encourage more competition and avoid instability in the banking industry.

Research limitations/ Implications: This research applies common practices in the measurement of banking stability namely, the Z score. Future studies may use a combination of data drawn from capital market capitalisations of bank assets and market stability to measure the modified Z score as a means to assess market feedback.

Keywords: Banking, Diversification, Foreign Bank Penetration, Interest Margin, Market Power, Stability
JEL Classification: G21

1. Introduction

Interest margin is a major source of bank profits in most emerging economies including ASEAN member countries. Higher interest margins will increase revenues which act as a buffer to bank failures. Low interest margins, in contrast, may also bring about a positive effect for both debtors and banks; it lowers loan interest rates thus, decreases the probability of borrower credit risks thereby, enhancing banking stability (Boyd & De Nicolo, 2005; Jimenez, Lopez, & Saurina, 2013). As a major source of the bank's income, interest margins should be kept at a certain level so as to maintain profits while simultaneously cushioning banking stability.

Boyd and De Nicolo (2005) developed a model on the relationship between banking competition and stability. Following the concept of credit rationing and the morale hazard model (Stiglitz & Weiss, 1981), Boyd and De Nicolo (2005) assume that borrowers' risk is perfectly correlated with the risk of the bank's default. In less competitive markets,

banks can charge higher interest rates which may increase the credit risk of debtors. This can result in more non-performing loans and so create greater instability in the banks. On the other hand, increased competition forces a bank to lower its interest rates which may then reduce the probability of loan defaults thereby, enhancing banking stability.

In extending Boyd and De Nicolo's (2005) model, Martinez-Miera and Repullo (2010) argue that there is an imperfect correlation between bank loan defaults and the probability of bank failures. The "competition-stability" view suggests that there is an increase in competition when new players enter the market and this can result in better banking stability (Schaeck, Cihak, & Wolfe, 2009; Boyd & De Nicolo, 2005; Berger, Klapper, & Turk-Ariss, 2009). However, in a tight and competitive environment, new players may cause an increased risk in bank failures (Repullo, 2004) based on the "competition-fragility" view (Keeley, 1990; Beck, Demirguc-Kunt, & Levine, 2006; Ariss, 2010; Leroy & Lucotte, 2016). However, Martinez-Miera and Repullo (2010) conclude that the relationship between competition and banking failure is not monotonic but it is instead, U-shaped, as is supported by empirical studies (Berger et al., 2009; Ariss, 2010; Jimenez et al., 2013).

The impact of business diversification on bank profitability and risks have been examined with inconclusive evidence. Kwast (1989), Jiangli and Pritsker (2008), Kwan (1997), Nguyen, Skully, and Perera (2012a), Sanya and Wolfe (2011), DeYoung and Torna (2013) and Lee, Yang, and Chang (2014) say that diversification into non-traditional banking products will increase bank returns and reduce bank risks thereby, boosting bank performance. Nonetheless, there are also studies (DeYoung & Roland, 2001; Stiroh, 2004; Lepetit, Nys, Rous, & Tarazi, 2008; Edirisuriya, Gunasekarage, & Dempsey, 2015; Williams, 2016; Maudos, 2017) which observe that a bank's expansion into non-traditional business activities will increase bank risks and lower bank profits.

Besides these variations noted in prior studies, there is also a conflict between banking literature and corporate finance literature which focuses on the impact of loan portfolio diversification on banking performance. Literature on financial intermediation (e.g., Diamond, 1984; 1991; Rajan, 1992; Boyd & Prescott, 1986; Ramakrishnan & Thakor, 1984) states that bank returns and banking stability will increase when a bank diversifies its credit portfolios. In Argentina, one of the causes that led to the banking crises was because the banks had concentrated on loan portfolios (Bebczuk & Galindo, 2008) and this apparently also happened in Austria (Rossi, Schwaiger, & Winkler, 2009).

Arguments from corporate finance literature support the stand that a bank should focus on one specific business or industrial sector to ensure that it benefits from its accumulated expertise in that area and reduces the problem of agency (Jensen, 1986; Berger & Ofek, 1995; Denis, Denis, & Sarin, 1997). A bank suffering from the conflict of interests between divisions (Rajan, Servaes, & Zingales, 2000; Lamont, 1997) or having too many types of operations may lose its focus (Demsetz & Strahan, 1997). This claim is supported by empirical evidence drawn from banking systems examined in Italy (Acharya, Hasan, & Saunders, 2006), China (Berger, Hasan, & Zhou, 2010a), Brazil (Tabak, Fazio, & Cajueiro, 2011) and Germany (Hayden, Porath, & von Westernhagen, 2007; Jhan, Memmel, & Pfingsten, 2016).

The current study is undertaken to fill the gaps noted in previous literature for a number of reasons. First, prior studies looking at the impact of market power and diversification on banking stability had been conducted mostly in developed banking systems. Thus, this study aims to address the position of banks in the ASEAN-4 countries which do not have an advanced banking system. Second, existing studies related to ASEAN countries are limited, with majority focusing on market power and revenue diversification (Nguyen et al., 2012a), non-interest income and bank's risk (Hidayat, Kakinaka, & Miyamoto, 2012), market power and diversification strategy on net interest margin (Bustaman, Ekaputra, Prijadi, & Husodo, 2016) and not the impact of net interest margin and loan portfolio diversifications on banking stability. Moreover, prior studies used the data of banking systems extracted from developed countries and Latin nations (Mercieca, Schaeck, & Wolfe, 2007; Acharya et al., 2006; Rossi et al., 2009; Tabak et al., 2011; Jhan et al., 2016). This study aims to contribute to literature by examining the combined effect of interest margin, market power, revenue diversification and loan portfolio diversification on banking stability in the ASEAN-4 countries.

This paper examines whether interest margin, competition or market power and the diversification strategy of banks in ASEAN-4 have any impact on the countries' banking stability. The findings indicate that intermediary activities that generate interest margins continue to be the major source of the banking revenues; they also cushion the risk of bank failures in the long run. When banks shift their activities to non-interest income products, especially fee-based income products, it decreases the interest margin hence, stabilising bank profits and banking stability. However, the lack of knowledge in trading activities can lead to an

augmented risk of banking. Banks specialising in certain types of loans might charge a higher margin due to their expertise in this area thereby, lowering banks' risk of failure. This study also finds that an increase in market power is due to the consequence of banking consolidations such as mergers and acquisitions as well as foreign bank penetrations. These can have a positive impact on banking stability in ASEAN-4.

The remainder of this paper is structured as follows: Section 2 provides the literature review on banking competition, interest margin and banking stability as well as literature related to banking diversification and risks. Section 3 describes the data collection, the empirical model used as well as the variables incorporated into the model testing. Section 4 presents the analysis of the findings and Section 5 concludes.

2. Literature Review

2.1 Banking Competition, Interest Margin and Banking Stability

According to Ho and Saunders (1981), market competition can affect a bank's interest margin which is part of the bank's profits and this acts as a buffer against the risk of loan losses. Martinez-Miera and Repullo (2010) note that an increase in banking competition will result in fluctuations of interest margin. This can affect the stability of the banks towards the two dimensions of the relationship between bank competition and stability in different directions. In a highly concentrated market, the entrance of new players will increase banking competition which can then lower loan interests for borrowers. At the same time, it also decreases interest margin for banks. This condition has a positive impact on debtors and banks as the risk of failure decreases for both parties (see Martinez-Miera & Repullo, 2010), a view that aligns with the competition stability view.

However, in a highly competitive market, the entrance of new players will result in a decrease in interest rate and interest margin. Some banks may even earn negative margins hence decrease their profit level and diminish their reserve for non-performing loans. As a consequence, the risk of bank failure increases, as noted by Martinez-Miera and Repullo (2010). Based on this, it can be said that there is no linear relationship between the degree of competition and banking stability. In other word, Martinez-Miera and Repullo conclude that there is U-shaped relationship between bank competition and risk of bank

failure. Using the data of Spanish banks, Jimenez et al. (2013) tested the theory of Martinez-Miera and Repullo and from the concentration levels noted in the market structure, their results confirmed the theory.

Employing the Lerner Index as a measurement degree of bank's market power, Keeley (1990) and Leroy and Lucotte (2016) show that market power has an inverse relationship with competition, supporting the competition-fragility hypothesis. Keeley (1990) and Leroy and Lucotte (2016) find that higher bank competition in the market erodes market power and so decreases the profit margin hence, resulting in higher risk failure. The findings noted by Jimenez et al. (2013) imply that the less competitive the market is, the more stable the banking system will be. In other words, a competitive banking system increases banking fragility. However, Jimenez et al. (2013) had only employed credit risk to measure risk; they did not provide the overall risk level of banking stability.

In another study, Berger et al. (2009) applied two measures of risk - the first was credit risk which used non-performing loans (NPL) and the second was the total overall bank risk measured by the Z score. The Lerner Index (LI) and Herfindahl-Hirschman Index (HHI) were used to measure competition. Their findings indicate that in developed countries, the higher the degree of market power or the less competitive the market is, the more stable the banking system becomes. This finding is in accordance with the "competition fragility" view. When NPL was used as a measurement of credit risk, an increase in market power would result in an increase in loan portfolio risks. This outcome is aligned with the "competition stability" view. In discovering the non-monotonic relationship between competition and banking stability in European regional banks, Liu, Molyneux, and Wilson (2013) confirm Martinez-Miera and Repullo's theory.

2.2 Banking Diversification and Risk

2.2.1 Revenue Diversification

Financial deregulation has eliminated the monopoly of banks in funding as well as credit sales. This has eroded the comparative advantages of a bank as a financial intermediary, making it easier for non-bank financial service competitors to compete in the same market. In response to the competition, banks have shifted to selling non-traditional products such as insurance, mutual funds and investments which are bundled

with traditional products to generate fee-based incomes (DeYoung & Roland, 2001; Stiroh, 2004; 2006).

It is argued that on the one hand, there are incentives for bankers to increase revenues from non-traditional sources because fee-based income is protected from interest rate movements and the fluctuations of economic conditions, unlike revenue generated from the sale of loans (DeYoung & Roland, 2001). It appears that revenue diversification reduces bank risk. On the other hand, DeYoung and Roland (2001) also provide three counter arguments. First, portfolio credits generate more stable income than non-traditional products because maintaining costs and enhancing portfolios of existing borrowers are cheaper for banks. In contrast, switching costs for borrowers to move to other banks are higher. This offers a tendency for lending relationships to be maintained beyond the short term. Second, a bank's operating leverage will increase when it expands its business to non-traditional products. This is because the bank will need to hire well-trained officers to sell the products. In comparison, a bank need not hire new officers to increase its credit portfolio from existing borrowers. Thus, the only cost incurred is the interest expense paid to depositors which reduces the bank's operating leverage. Third, no additional capital is required to increase a bank's non-traditional activities hence, increasing returns on equity.

DeYoung and Roland (2001) examined the relationship between revenue diversification and risks of 472 banks in the U.S. from 1988 to 1995. They find that banks which shifted from selling traditional products to fee-based income products experience a higher volatility of earnings which is accompanied by increased leverage. This result suggests the existence of possible risk premiums due to increasing non-traditional activities. Stiroh (2004) finds little evidence to show that the shift in the business has a positive impact on profits and income stability within the U.S. banking industry between 1984-2001. The growth rate between the bank's net interest income and non-interest income becomes more correlated at the bank level. Income from service charges and fees has a higher correlation with net interest income. In contrast, there is lower correlation between income from trading and fiduciary activities (such as fees from services rendered by the bank in the remittance of dividends from a company to its shareholders) with net interest income.

At the aggregate level, a decreasing volatility of the net interest income provides a greater benefit than a positive impact of diversification from non-interest income. Accordingly, this can result in a lower volatility of net operating profits. The bank's dependence on income

drawn from non-traditional activities has also resulted in a higher risk and lower risk-adjusted profits. Stiroh's (2004) findings support Stiroh and Rumble's (2006) study which examined financial holding companies in the U.S. between 1997-2002. Meanwhile, during the 2007-2010 financial crisis in the U.S., the probability of bank defaults is noted to be lower for banks, which offered pure fee-based non-interest income such as brokerage fee and insurance commission. In contrast, bank risk increases with asset-based non-traditional products such as asset-back securitisation and investment banking (DeYoung & Torna, 2013). Focusing on Australian banking industry, Williams (2016) observes that banks with higher levels of non-interest income face more risk. During the financial crisis, it appears that the size of the bank influences the scale of the risks thus, size also has a positive relationship with risk.

The findings obtained by DeYoung and Roland (2001), Stiroh (2004) and Stiroh and Rumble (2006) have been endorsed by other studies, such as Lepetit et al. (2008), Mercieca et al. (2007) and Maudos (2017). Using the European banking data to examine the impact of the diversification of non-interest income on banking risk, Mercieca et al. (2007), for example, suggest that the high dependence of small-sized banks on non-traditional businesses can be associated with the banks' higher risk and lower performance. The study indicates that small-sized banks lack the expertise and experience in selling non-traditional banking products such as commission and fee-based activities and trading activities (Lepetit et al., 2008). During the financial crisis experienced by the European banking industry from 2008 to 2012, Maudos (2017) find that an increase in non-traditional banking activities lowers bank profitability and increases bank risk. However, studies conducted by several researchers who examined the shifting focus of the banking business to non-interest income and its impact on bank performance in some emerging market countries find that the outcomes mostly support the conventional wisdom view (see Nguyen, Skully, & Perera, 2012b; Gamra & Plihon, 2011; Sanya & Wolfe, 2011; Edirisuriya et al., 2015; Li & Zhang, 2013).

2.2.2   *Loan Portfolio Diversification*

Winton (1999) developed a theoretical framework model on diversification to tackle the issue of whether it is better for banks to diversify their loan portfolio, as suggested by the theory of financial intermediary, or to focus on their controlled areas, as suggested by the

theory of corporate finance. Winton's (1999) theoretical model has been tested by other researchers who are discussed below.

Focusing on the Italian banking industry, Acharya et al. (2006) examined how loan portfolio diversification impacts banking performance. They find that the diversification of both the industrial and sectoral loan lowers the return. Loan diversification can result in higher credit risk for high-risk banks whereas diversification for low-risk banks can result in either inefficient trade-offs between risks and returns or it might generate marginal performance improvement only. These findings are very important and in accordance with the classical theory of credit monitoring (Diamond, 1984; Winton, 1999). This theory implies that the effectiveness of bank monitoring is weakened when risky banks have poorer loan portfolios and when banks expand their credit portfolios into new sectors and new businesses.

Looking at the Chinese banking industry, Berger et al. (2010a) note that the diversification of credits, deposits and geographic expansion produces uneconomic banking, decreases profits and increases costs. Opposite to the diversification move, a focused bank generates higher profits and lower costs (Berger et al., 2010a). Studying the Russian banking industry and how it enjoys high profits and lower risks when many of the banks become more focused, Berger, Hasan, Korhonen, and Zhou (2010b) note that the increase in the profits and decrease in the risks can only occur until a certain threshold limit.

The diversification of loan portfolios in Brazilian banks was studied by Tabak et al. (2011). They observe that diversification can lead to lower returns and higher default risks. The outcome noted contradicts Rossi et al. (2009) who find that in Austria, credit diversification into sectors increases bank profit efficiency but lowers the bank's realised risk which is measured by the amount of provisions made for bad loans.

From the German perspective, the negative results of diversification are also obtained by Hayden et al. (2007) and Jhan et al. (2016) who examined the relationship between profitability and the diversification of credit portfolios across industry, sector and geography in Germany. Those forms of diversification do not generate greater profits; in fact, they lower bank returns. The impact of diversification on bank performance is determined by the risk level of the bank. It appears that greater diversification benefits can be obtained when a bank has moderate risk and when it diversifies its portfolio across the industrial sector (Hayden et al., 2007).

3.   Research Method

3.1 *Data Sources*

In this study, the data used for analysis were extracted from the annual financial information of 133 listed and non-listed commercial banks in Indonesia (68 banks), Malaysia (27 banks), Thailand (20 banks) and the Philippines (18 banks) during the period between 2006-2012. The data collected represent around 66 per cent to 85 per cent of the bank assets of each country. This study excludes banks from Singapore because Singapore has attained a developed status; moreover, it is one of the major international financial hubs in the world. This study also excludes other ASEAN countries due to inaccessibility to data.

This study employed the unbalanced panel data. To be included in this sample, the banks observed must have data for the main variables (Z score, net interest margin, market power and diversification) for at least three consecutive years during observation period. The banks' financial reports were retrieved from the Bank Scope Fitch IBCA database to compute net interest margin (NIM), Lerner Index (LI) and the control variables as well as the degree of foreign bank penetration. A detailed data separating loan portfolio distribution into business sector, types of loan, fee and trading income were not available on the Bank Scope, thus diversification or focus indices were processed from the detailed financial reports issued by each bank. Meanwhile, the macroeconomic data of every country were captured from the World Bank database.

3.2 *Empirical Model*

In examining the impact of bank interest margin, competition and diversification strategy on banking stability in ASEAN-4 , this study employed an empirical model which allows for non-linear relationship between banking stability and the degree of market power, following the works of Martinez-Miera and Repullo (2010), Berger et al. (2009) and Jimenez et al. (2013). The model applied is as follows:

$$
\begin{aligned}
Risk_{i,j,t} = {} & \alpha + \beta_1 NIM_{i,j,t} + \beta_2 MP_{i,j,t} + \beta_3 MP^2_{i,j,t} + \beta_4 SFOC_{i,j,t} + \beta_5 TFOC_{i,j,t} \\
& + \beta_6 RFOC_{i,j,t} + \beta_7 NFOC_{i,j,t} + \beta_8 NNON_{i,j,t} + \beta_9 ForP_{i,j,t} \\
& + \sum_{n=1}^{N} \epsilon_n\, BS_{n,t} + \sum_{k=1}^{K} \theta_k\, ME_{k,t} + \sum_{k=1}^{\epsilon} \zeta_c\, D_c + \varepsilon_{,i,j,t}
\end{aligned}
\tag{1}
$$

3.2.1 Bank Risks

In conducting this study, the concepts used are defined accordingly. Subscripts *i, j* and *t* refer to bank, country and time respectively. Bank risk is measured by using the Z score, widely used in banking literature, as an indicator of banking stability (Berger et al., 2009; Carretta, Farina, Fiordelisi, Schwizer, & Lopes, 2015). It is a proxy for the bank's distance to default; the higher the Z score the lower the probability of default or the more stable the bank is. This measure provides information revealing bank soundness; it will also indicate the number of standard deviation units by which the bank's profitability have to decline to a certain level before capital is completely exhausted. This study adopts Lepetit and Strobel's (2013) method to measure the Z score which is calculated with the following formula:

$$Z_{i,j,t} = \frac{\overline{ROA_{i,j,t}} + E/TA_{i,j,t}}{\sigma ROA_{i,j,t}} \qquad (2)$$

Here, ROA is the average return on assets; σROA is average standard deviation of returns. Both are calculated over the full sample of each country; E/TA is the current period t value equity over the assets of each bank. The stability of the bank will increase with an enlargement in profits and capital placed by the shareholders; this will decrease when the standard deviation of returns on assets increases.

3.2.2 Independent Variables

Net interest margin (NIM) is the ratio between the difference in interest income and interest expense divided by total assets. It becomes the central measurement of a bank's profit as an intermediary between depositors and borrowers.

This study uses a method that directly measures the degree of competition imposed by new empirical industrial organisation (NEIO) - Lerner Index (LI), which is a proxy measure of the market power (MP) of individual banks. In the banking literature, market power has an inverse relationship with the degree of competition (see Matthews & Thompson, 2005). If market power is high, then the degree of banking competition will be low and vice versa. The Lerner Index (LI) represents the mark-up price to marginal cost; it is an indicator which indicates the market power of a bank (Berger et al., 2009). According to Beck, De Jonghe, and Schepens (2013), LI is a proxy of the current and future profit derived from the strength of the pricing power, both in terms of

assets (loans) as well as funding (liability). There are several reasons for using the Lerner Index: (a): using this to measure the degree of bank competition provides the opportunity to capture the equilibrium of a banking industry in the long term; and (b) each individual bank is unique thus, LI can better accommodate the uniqueness of individual banks in terms of bank size, geographical operational coverage, products offered etc. thus, ensuring that the degree of competition will be different for the individual banks (Berger et al., 2009).

Alternative measurements of the market power or market structure of competitions employed to check the robustness of this study are: (a) market concentration ratio namely Herfindahl-Hirschman Index (HHI); and (b) bank concentration ratio (CRn). The HHI of banking market concentration is defined as the sum of the square of market shares of all bank loans existing in each country. Meanwhile, in this study, the CRn is defined as the share of the largest three banks in terms of total banking sector loans (CR3) in each country. The market and bank concentration ratios (HHI and CRn) are exogenous indicators of the market power. Similar with LI, they are an inverse indicator of the intensity of competition (see Berger, Demirguc-Kunt, Levine, & Haubrich, 2004; Jimenez et al., 2013; Carbo, Humphrey, Maudos, & Molyneux, 2009)

To measure whether a bank is focused or a specialist in a particular field or one with a diversified business or loan portfolio, this study employs the modified Herfindahl-Hirschman Index (modified HHI), as used by Acharya et al. (2006), Berger et al. (2010b) and Hayden et al. (2007). The modified HHI is the sum of the squares of the fractions' exposure according to the classification that would be measured. Bank diversification can be classified by the sector or the geographical area. In this study, the diversification of credit will be divided into two categories namely, by business sectors (SFOC) and by types of facilities (TFOC), both of which, cover consumption credit, working capital credit and investments and exports credit.

The proportion of exposure to a particular sector, compared to the credit portfolio in general, is X1, X2 to Xn, and the equation for calculating the focus index is as follows:

$$FOC = \sum_{i=1}^{n} \left(\frac{X_i}{Q}\right)^2 \text{ and } Q = \sum_{i=1}^{n} X_i \tag{3}$$

$$Q = \sum_{i=1}^{n} X_i \tag{4}$$

The maximum value of bank focus (FOC) is 1 and this is given to a bank that focuses its income or portfolio on only one sector or industry. In other words, this bank does not diversify its assets or products. When a bank is perfectly diversified, the FOC index becomes $1/n$.

The diversification of non-interest income is also divided into two categories: (a) the diversification of income, consisting of interest income and non-interest income, referred to as RFOC; (b) the diversification is within non-interest income consisting of provision / commission, trade and others (NFOC) as used by Mercieca et al. (2007). The measurement of the diversification in products that generate interest income and non-interest income is as follows:

$$RFOC = \left(\frac{NON}{NETOP}\right)^2 + \left(\frac{NET}{NETOP}\right)^2 \qquad (5)$$

NON is the revenue from non-interest income, NET is the revenue from interest income while NETOP is the summation of NON and NET. The higher the value of RFOC, the more focused the bank is, in selling its products, whether interest income products or non-traditional products. Meanwhile, the following equation is used to measure the diversification within non-interest income:

$$NFOC = \left(\frac{FEE}{NON}\right)^2 + \left(\frac{TRD}{NON}\right)^2 + \left(\frac{OTOP}{NON}\right)^2 \qquad (6)$$

FEE is income from commissions and fees, TRD is revenue from trading activities, OTOP is other non-interest income.

Another alternative measurement for revenue diversification is NNON (net non-interest income), which is the difference between non-interest income and non-interest expense over total assets (Valverde & Fernandez, 2007). Following Maudos and Solis (2009), this study also separates the non-interest income into two variables: (a) income from commissions and fees; and (b) income from trading.

3.2.3 Control Variables

This paper also introduces a set of control variables: foreign bank penetration, bank specific variables, macroeconomic variables and dummy variables, as shown in Equation (1).

Foreign bank penetration (ForP)
Some scholars (Demirguc-Kunt, Laeven, & Levine, 2004; Claessens, Demirguc-Kunt, & Huizinga, 2001; Goldberg, 2002; Peek & Rosengren, 2000) have observed that foreign bank penetration increases banking stability in the host country. In this regard, foreign bank penetration is measured as a percentage of total banking assets in a banking system owned by foreign banks within a particular country. The definition of foreign bank used here complies with the categories employed by the World Bank and used within the bank scope. A bank is described as foreign owned when foreign ownership exceeds 50 per cent.

Bank specific variables (BS)
BS is a vector for bank specific variables. It comprises size of assets, size of credit portfolio, bank liquidity, credit risk and the efficiency costs of banks. Size of assets is one factor in higher risk taking caused by the "too big to fail" effect in larger banks (Soedarmono, Machrouh, & Tarazi, 2013; Mishkin, 1999). The size of loan portfolio is measured by the ratio of loans to total assets (LTA). The higher the credit portfolio is, the higher the bank's exposure to risk of failure and this suppresses banking stability (Altunbas, Carbo, Gardener, & Molyneux, 2007; Berger et al., 2009; Stiroh & Rumble, 2006). Bank liquidity (LIQ) is measured by its liquid assets (cash plus cash equivalent) over its total assets. Banks with higher liquidity have lower risks (Liu, Molyneux, & Nguyen, 2012) but Wagner (2007) demonstrates that banks with higher liquidity may also have lower banking stability. This is because liquid assets are not required in bank capital adequacy requirements. The credit risk variable (CRISK) is measured by loan loss provisions over total loans. Uhde and Heimeshoff (2009) noted that increasing credit risk can negatively impact stability. The last banking-specific variable is efficiency (EFF) which is measured by total operational cost over total revenue. Good cost efficiency promotes banking stability (Uhde & Heimeshoff, 2009) while inefficient banks tend to have lower quality credit portfolios (Williams, 2004). This can increase problem loans (Berger & DeYoung, 1997).

Macroeconomic conditions (ME)
ME is the vector of the control variables for the macroeconomic conditions existing in each country. Three macroeconomic variables are applied: the economic growth rate (GDPG), inflation (INF) and the depreciation of the exchange rate (DEPCUR). From the theoretical perspective, economic growth and inflation have a relationship with financial stability. In their study, Levine, Loayza, and Beck (2000)

highlight the positive relationship between the development of financial institutions and economic growth with bank failure as a consequence of the decline in the economic cycle. It is also noted that inflation rate and economic growth are likely to affect the quality of bank assets (Beck et al., 2006). The effect of inflation rate movement depends on whether the bank manager had anticipated it or not or whether it corresponds with the general economic fragility. In most common situations, inflation increases interest rates and this can cause bank margins and profitability to increase. It is also noted that when bank funding increases, bank profitability may have to depend on the net effect of inflation rate movement and costs. An increase in interest rate may affect the repayment capacity of borrowers and this can cause an increase in loan default probabilities (Uhde & Heimeshoff, 2009). From their study, Soedarmono, Machrouh, and Tarazi (2011) note that in countries with higher economic growth, banks can neutralise the risk taking instances. In other studies (e.g., Nilsen & Rovelli, 2001; Fu, Lin, & Molyneux, 2014), it is observed that the withdrawal of foreign capital in one country is affected by its weak macroeconomic conditions. Nonetheless, in the period of economic growth, financial instability may increase but only if banks perceive that it is more profitable to diversify quickly during that period (Sanya & Wolfe, 2011).

Currency depreciation (DEPCUR)
Another control variable is the rate of currency depreciation in each country. The vulnerability of banks to capital outflow can also be triggered by the collapse of currency exchange which can in turn, cause a financial crisis (Demirguc-Kunt & Detragiache, 1998; Kaminsky & Reinhart, 1999). This twin crises can worsen a country's economic fundamentals while the collapse of the exchange rate can trigger the purchase of assets including bank assets of that country by foreign investors.

Other control variables
Apart from banking micro variables and macroeconomic conditions, this study also controls for institutional environment, ownership and the country where the bank is located. It is assumed that the types of bank ownership is also a factor that can determine the stability of the banking system (Berger et al., 2004). To examine this, the current study will contrast the effect of ownership between government vs private owned banks and local vs foreign owned banks. Berger et al. (2004) state that government ownership is in general, associated with bad outcomes

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caused by the morale hazard problem and the public's poor access to credits. This situation can lower the banking stability. In contrast, private and foreign owned banks are often associated with more favourable outcomes that benefit their customers due to their easy accessibility to credits. The current study also includes host country dummy as a means to capture the effect of the national bank's operating location (Indonesia, Malaysia, Thailand and the Philippines) on banking stability.

Table 1 shows the summary of variables used in this research.

Table 1: Summary of Variables

Variables	Measurement	References
Dependent Variable		
Bank Stability	Z score, as a proxy for the bank's distance to default	Berger et al. (2009), Carretta et al. (2015)
Independent Variables		
Net Interest Margin (NIM)	Ratio between the difference in interest income and interest expenses over total assets	Ho and Saunders (1981), Lepetit et al. (2008), Bustaman et al. (2016)
Market Power (MP) or Market Structure of Competition	Lerner Index (LI) represents the mark-up price to marginal cost, which indicates market power of individual bank. Market power has an inverse relationship with degree of bank competition	Berger et al. (2009), Ariss (2010), Beck et al. (2013)
	Herfindahl-Hirschman Index (HHI) is banking market concentration, defined as the sum squares of the market shares of all of banks' loans in each country.	Berger et al. (2004), Jimenez et al. (2013)
	Concentration Ratio (CR3) represents the shares of largest three banks in total banking sector loans in each country	Berger et al. (2004), Jimenez et al. (2013)
Loan Diversification divided into two variables: (1) Business Sector Loan Diversification (SFOC); and (2) Type of Facilities Diversification (TFOC)	Modifications of the Herfindahl Hirschman Index (HHI) to measure diversification by business sector (SFOC) and by type of facilities (TFOC)	Acharya et al. (2006), Berger et al. (2010b), Hayden et al. (2007)

Revenue Diversification divided into two variables: (1) Diversification of interest income and non-interest income (RFOC); and (2) Diversification within non-traditional activities that generate non-interest income (NFOC	Modifications of the Herfindahl Hirschman Index (HHI) to measure revenue diversification of interest income and non-interest income (RFOC), and diversification within non-traditional activities that generate non-interest income (NFOC)	Mercieca et al. (2007)
Net Non-Interest Income (NNON))	Alternative measurement of revenue diversification, ratio of non-interest income over total asset	DeYoung and Roland (2001), Stiroh and Rumble (2006), Maudos and Solis (2009), Lee et al. (2014)
Fee & Commission (FEE)	Ratio of fee and commission income over total assets	Maudos & Solis (2009), Mercieca et al. (2007)
TRADING	Ratio of trading income over total asset	Maudos and Solis (2009), Mercieca et al. (2007)
Foreign Bank Penetration (ForP)	Percentage of total foreign banks assets in a banking system. A bank is categorised as foreign owned when its foreign ownership exceeds 50%	Demirguc-Kunt et al. (2004), Claessens et al. (2001), Goldberg (2002)

Bank Specific Variables

Size of Bank (Size Assets)	Size of bank measured by total bank assets	Soedarmono et al. (2013), Williams (2016)
Size of Loan Portfolio (LTA)	Ratio of loans over total assets	Mercieca et al. (2007), Stiroh and Rumble (2006), Lepetit et al. (2008), Lee et al.(2014)
Liquidity (LIQ)	Ratio of liquid assets over total assets	Liu et al. (2010), Wagner (2007)
Credit Risk (CRISK)	Ratio of loan loss provision over total loan	Berger et al. (2010a), Uhde and Heimeshoff (2009), Lee et al. (2014)
Efficiency (EFF)	Ratio of total operational cost over total revenue	Altunbas et al. (2007), Berger and DeYoung (1997), Bustaman et al. (2016)

Macroeconomic Variables

Currency Depreciation (DEPCUR)	Currency depreciation in each country	Demirguc-Kunt and Detragiache (1998); Kaminsky and Reinhart (1999)
Economic Growth Rate (GDPG)	GDP growth in each country	Soedarmono et al. (2011), Fu et al. (2014)

Inflation (INF)	Inflation rate in each country	Maudos and Solis (2009), Uhde and Heimeshoff (2009)
Dummy Variables		
Ownership	Ownership Variable	
Govt vs Private	Take the value of 1 if bank is owned by government, and 0 otherwise	Uhde and Heimeshoff (2009)
Local vs Foreign	Take the value of 1 if the bank is owned by foreigner and 0 otherwise	Berger et al. (2009), Claeys and Hainz, (2014)
Host Country Dummy	Take the value of 1 if the bank is located in certain home country and 0 otherwise	Maudos and de Guevara (2004), Edirisuriya et al. (2015)

4. Results and Analysis

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics drawn from the analysis. The statistics indicate that the average bank interest margin of ASEAN-4 between 2006-2012, is relatively high i.e., 3.45 per cent (rounded up to two decimal points). However, there is a downward trend in the bank interest margin. In year 2006, the average net interest margin (NIM) is 3.65 per cent but in 2012, it dropped to 3.19 per cent. Among the four countries, Indonesia has the highest NIM level of 4.67 per cent (not shown in the Table but available upon request). The mean Lerner Index (LI) is 0.21. Judging from the serial data, it is deduced that the LI figure is likely to increase in the aftermath of the global financial crisis of 2007-2010, as seen in Table 2. The increased marketing power may be due to the country's banking consolidation exercises such as mergers and acquisitions by large banks and foreign banks.

The mean shown by the Z score is 23.82, suggesting that banking stability is increasing from year to year, as marked by the increasing Z score of this period. The loan diversification by business sector (SFOC) shows average credit diversification (0.43). The focus index or diversified loan portfolio by type of credit use (TFOC) shows a moderate figure, 0.61. The diversification of the income sources (interest income and non-interest income) was measured by the RFOC. It appears that the banking industry of ASEAN-4 is still focused on the source of interest income

as noted in the average RFOC of 0.74. This focus index is relatively stable from year to year. The NFOC index also shows that the source of non-interest income in the banking system is focused on one source (fee and commission) only, as indicated by the average index of 0.62. The alternative measurement of the non-interest income measurement is NNON and statistics suggest that a decrease in negative value of the NNON will indicate an increase in income from non-traditional products. The penetration of foreign banks (ForP) in ASEAN-4 was noted by the average degree of 0.24. The serial data also show that the ownership of bank assets by foreign banks increased in the period of crisis, from 2007 to 2010 and the situation stabilised in the period after that.

4.2 Empirical Results and Analysis

The risk model shown in Equation (1) is estimated with the random effect panel data. Country specific variables were included in the model (see Demirguc-Kunt et al., 2004). The data for ASEAN-4 were compiled including country dummies and country specific factors [Economic Growth Rate (GDPG), Inflation (INF) and Currency Depreciation (DEPCUR)] as a means to capture specific effects of each country. A dynamic approach was applied to the model to accommodate the stochastic arrival of deposit and demand for loans and non-traditional activities during the period that could affect bank interest margin and banking risks (Valverde & Fernandez, 2007; Maudos & Solis, 2009). The System Generalized Method of Moment (GMM) (see Arellano & Bover, 1995; Blundell & Bond, 1998) was applied to estimate the dynamic model. This method estimates the regression in differences and jointly with the regression in levels. To minimise the endogenity problem of the explanatory variables, lagged levels and lagged differences were used as intruments. In this process, the one step GMM estimator with asymptotic standard errors robust to heteroskedascity, was used. The validity of the instruments and assumptions was tested using Sargan's test (see Arellano & Bond, 1991) which helps to ensure that there is no serial correlation on the error term. The results are presented in Table 3.

Table 3 displays the summary of the regression model estimation (static and dynamic models) and the determinant factors of banking stability (Z score). There are eight columns in the table – four columns

Table 2: Descriptive Statistics

	2006	2007	2008	2009	2010	2011	2012	MEAN
DEPENDENT VARIABLE								
Z SCORE Mean	21.695	22.742	22.609	23.982	24.616	25.146	25.934	23.818
Standard Deviation	20.126	20.929	17.976	19.232	18.393	19.315	20.226	19.457
MAIN INDEPENDENT VARIABLES								
NIM (%)	3.65	3.37	3.64	3.70	3.41	3.17	3.19	3.447
	0.027	0.023	0.023	0.021	0.019	0.018	0.020	0.022
MARKET POWER (MP)								
- LERNER INDEX (LI)	0.166	0.153	0.171	0.165	0.254	0.260	0.266	0.205
	0.231	0.294	0.249	0.315	0.293	0.253	0.281	0.274
-HHI	0.174	0.195	0.187	0.177	0.209	0.090	0.094	0.161
	0.172	0.224	0.226	0.215	0.300	0.027	0.027	0.170
- CR3	0.622	0.634	0.611	0.599	0.586	0.529	0.540	0.589
	0.114	0.148	0.161	0.165	0.173	0.077	0.079	0.131
ForP	0.189	0.185	0.260	0.269	0.259	0.244	0.246	0.236
	0.115	0.109	0.092	0.063	0.033	0.069	0.084	0.081
SFOC	0.435	0.439	0.440	0.427	0.417	0.410	0.406	0.425
	0.249	0.264	0.260	0.246	0.252	0.238	0.237	0.249
TFOC	0.592	0.605	0.615	0.604	0.613	0.606	0.608	0.606
	0.230	0.233	0.238	0.230	0.232	0.231	0.228	0.231
RFOC	0.740	0.733	0.749	0.744	0.743	0.748	0.743	0.743
	0.119	0.116	0.123	0.140	0.153	0.148	0.149	0.135
NFOC	0.592	0.599	0.610	0.632	0.636	0.646	0.643	0.623
	0.208	0.205	0.199	0.211	0.213	0.215	0.212	0.209
NNON	-0.022	-0.020	-0.022	-0.019	-0.020	-0.018	-0.017	-0.020
	0.022	0.018	0.020	0.022	0.025	0.018	0.019	0.021
- FEE	0.006	0.007	0.006	0.006	0.006	0.005	0.006	0.006
	0.005	0.005	0.004	0.005	0.006	0.006	0.007	0.005
- TRADING	0.008	0.009	0.007	0.010	0.010	0.010	0.010	0.009
	0.008	0.011	0.012	0.014	0.015	0.014	0.015	0.013

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BANK SPECIFIC VARIABLES

Size Assets	18.917	19.245	19.234	19.078	18.948	18.813	19.118	19.050
	5.080	**5.227**	**5.191**	**5.000**	**4.848**	**4.750**	**4.757**	**4.979**
LTA	0.516	0.551	0.572	0.560	0.574	0.580	0.598	0.564
	0.178	**0.172**	**0.179**	**0.194**	**0.178**	**0.167**	**0.162**	**0.176**
LIQ	0.061	0.080	0.080	0.075	0.071	0.065	0.042	0.068
	0.093	**0.125**	**0.113**	**0.096**	**0.094**	**0.088**	**0.071**	**0.097**
CRISK	0.010	0.014	0.009	0.016	0.005	0.005	0.006	0.009
	0.012	**0.029**	**0.011**	**0.034**	**0.004**	**0.009**	**0.009**	**0.015**
EFF	0.871	0.850	0.861	0.823	0.794	0.803	0.810	0.830
	0.246	**0.183**	**0.257**	**0.267**	**0.238**	**0.210**	**0.199**	**0.229**

MACROECONOMIC VARIABLES

DEPCUR	-0.087	-0.023	0.112	-0.093	-0.066	0.017	0.013	-0.018
	0.017	**0.077**	**0.052**	**0.064**	**0.027**	**0.015**	**0.055**	**0.044**
GDPG (%)	5.425	6.183	5.028	1.965	6.873	4.920	6.417	5.259
	0.169	**0.480**	**1.253**	**2.991**	**0.699**	**2.226**	**0.617**	**1.205**
INF (%)	5.235	3.953	7.989	2.660	4.929	3.685	3.173	4.518
	1.462	**1.144**	**3.839**	**1.166**	**2.232**	**0.299**	**0.779**	**1.560**

OWNERSHIP - DUMMY VARIABLES

GOVERNMENT	0.158	0.158	0.158	0.158	0.158	0.158	0.158	0.158
	0.367	**0.367**	**0.367**	**0.367**	**0.367**	**0.367**	**0.367**	**0.367**
PRIVATE	0.849	0.849	0.849	0.849	0.849	0.849	0.849	0.849
	0.360	**0.360**	**0.360**	**0.360**	**0.360**	**0.360**	**0.360**	**0.360**
DOMESTIC	0.712	0.712	0.712	0.712	0.712	0.712	0.712	0.712
	0.455	**0.455**	**0.455**	**0.455**	**0.455**	**0.455**	**0.455**	**0.455**
FOREIGN	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349
	0.479	**0.479**	**0.479**	**0.479**	**0.479**	**0.479**	**0.479**	**0.479**

Notes : Z score = Measure of bank stability; NIM = Net interest margin; Lerner Index (LI) = measure of market power or degree of bank competition; HHI = Herfindahl-Hirschman Index; CR3 = Concentration ratio of three biggest bank's loan portfolio; ForP = Foreign bank penetration; SFOC = Business sector loan diversification; TFOC = Type of loan facility diversification; RFOC = Diversification of interest income and non-interest income; NFOC = Diversification within non-interest income; NNON = Net non-interest income; FEE = Income from fee and commision, measured by ratio of fee and commission income over total assets; TRADING = Income from trading measured by ratio of trading income over total asset; Size Assets = Size of bank assets; LTA = Size of loan portfolio, mesured by ratio of loan to total assets; LIQ = Liquidity, measured by ratio of liquid asset over total assets; CRISK = Credit risk, measured by ratio of loan loss provision over total loan; EFF = Efficiency, measured by ratio of total operational costs over total revenue; DEPCUR = Currency depreciation in each country; GDPG = Economic growth rate in each country; INF = Inflation rate in each country; GOVERNMENT = Bank dummy government ownership; PRIVATE = Bank dummy private ownership; DOMESTIC = Bank dummy domestic ownership; FOREIGN = Bank dummy foreign ownership

Table 3: Summary Determinant of Z Score, Market Power Lerner Index

| | Static Model | | | | Dynamic Model | | | |
	1	2	3	4	5	6	7	8
Z Score (-1)					0.6855***	0.6248***	0.6537***	0.7036***
					(0.000)	(0.000)	(0.000)	(0.000)
NIM	161.3350***	130.4410***	130.5240***	261.8820**	24.2958	-25.0270	53.2182	-283.3740
	(0.000)	(0.002)	(0.000)	(0.091)	(0.801)	(0.806)	(0.591)	(0.617)
Market Power (MP)	4.8695*	6.9741**	-12.9001	-9.2214	5.3696	3.8097	-5.1743	5.7139
	(0.098)	(0.018)	(0.272)	(0.454)	(0.538)	(0.627)	(0.900)	(0.930)
Market Power (MP)^2			2.4516				2.9373	
			(0.314)				(0.739)	
ForP	18.2892***			16.6645***	22.5565		30.0850	-2.0053
	(0.002)			(0.005)	(0.195)		(0.171)	(0.910)
Foreign Own		1.4452	1.3601			13.6115		
		(0.739)	(0.748)			(0.109)		
Govt Own		-5.3007	-5.3291			3.3374		
		(0.390)	(0.374)			(0.786)		
SFOC	-3.4528	-2.8194	-2.2724	3.2891	-7.4099	-9.0268	-5.8835	6.3805
	(0.207)	(0.309)	(0.412)	(0.390)	(0.403)	(0.314)	(0.505)	(0.737)
TFOC	8.0188**	6.5936**	6.1888*	-2.4986	9.5747	8.9761	8.6362	0.4277
	(0.013)	(0.042)	(0.058)	(0.677)	(0.280)	(0.459)	(0.358)	(0.985)
RFOC	-7.9670**	-5.4564	-13.9069**	-7.7110	-26.1847**	-12.6163	-31.4064*	27.5730
	(0.032)	(0.142)	(0.011)	(0.258)	(0.015)	(0.114)	(0.096)	(0.495)
NFOC	-2.1044	-2.1346	-1.5710	-5.5377	-2.6778	2.8229	-0.8705	-68.2801
	(0.359)	(0.361)	(0.504)	(0.236)	(0.669)	(0.732)	(0.895)	(0.102)
NNON	5.6789	-20.8915			-40.1346	-74.9114		
	(0.865)	(0.527)			(0.748)	(0.548)		
FEE			125.0000**				209.2180	
			(0.050)				(0.382)	

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TRADING			-58.8605** (0.047)				-98.0110 (0.380)	
MP*RFOC			27.7069* (0.065)	30.9067** (0.045)			9.6415 (0.844)	21.2050 (0.714)
MP*SFOC				-8.2564 (0.325)				-5.5296 (0.908)
NIM*MP				104.3610 (0.431)				-207.8510 (0.719)
NIM*SFOC				-232.7230** (0.020)				-73.1861 (0.876)
NIM*TFOC				294.1080** (0.028)				42.2973 (0.949)
NIM*RFOC				-282.6860* (0.072)				-441.1860 (0.654)
NIM*NFOC				99.0967 (0.318)				1012.3500 (0.320)
Size Assets	-1.2352*** (0.000)	-1.1093*** (0.001)	-1.2268*** (0.001)	-1.1857*** (0.002)	-0.9352** (0.045)	-1.5061*** (0.004)	-1.0125 (0.056)	
LTA	-0.7434 (0.824)	0.6436 (0.848)	1.0114 (0.763)	0.0736 (0.910)	-10.7253 (0.133)	-0.8936 (0.900)	-12.4651 (0.145)	
LIQ	0.3170 (0.962)	-1.7984 (0.789)	-4.5646 (0.504)	-0.6444 (0.923)	30.6470 (0.237)	-1.1393 (0.965)	30.9567* (0.298)	
CRISK	17.6455 (0.375)	25.7212 (0.201)	18.3368 (0.295)	17.1979 (0.308)	-112.8960 (0.343)	-142.2210 (0.331)	-139.6260 (0.333)	
EFF	5.9536* (0.070)	5.3141 (0.112)	6.4488*** (0.010)	5.8376 (0.023)	6.9125 (0.381)	2.6052 (0.773)	6.7319 (0.345)	
DEPCUR	-0.7300 (0.918)	-3.2908 (0.649)	-4.9971 (0.496)	-2.9360 (0.682)	5.2615 (0.728)	-1.2832 (0.923)	-3.0005 (0.843)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDPG	-0.1374	-0.095801	-0.1116	-0.1424	0.3341	0.3586	0.0858
	(0.502)	(0.645)	(0.592)	(0.485)	(0.361)	(0.286)	(0.834)
INF	-0.1049	-0.1495	-0.1242	-0.0560	0.0968	0.1256	0.2061
	(0.549)	(0.401)	(0.485)	(0.750)	(0.793)	(0.695)	(0.579)
MALAYSIA	7.4029	5.7179	6.3910	6.2744	12.0668*	11.2819	12.2887
	(0.237)	(0.371)	(0.311)	(0.397)	(0.089)	(0.258)	(0.176)
THE PHILIPPINES	0.9908	3.1195	3.2571	2.5489	-1.2598	4.4066	-0.2510
	(0.863)	(0.592)	(0.569)	(0.682)	(0.878)	(0.598)	(0.976)
THAILAND	17.5669***	17.0913***	17.5480***	16.7667**	12.9752*	19.6966***	13.3479
	(0.006)	(0.008)	(0.007)	(0.038)	(0.071)	(0.006)	(0.071)
Constant	33.9013***	33.5613***	40.2813***	35.7690***	32.1349*	32.1716*	36.9946
	(0.000)	(0.000)	(0.000)	(0.001)	(0.079)	(0.091)	(0.085)
R^2	0.1846	0.1662	0.1854	0.2135			
Sargan(test)				[0.997]	[1.000]	[1.000]	[1.000]
AR(1)-test				[0.002]**	[0.017]*	[0.008]**	[0.020]*
AR(2)-test				[0.419]	[0.705]	[0.566]	[0.582]

Notes: Z score (-1) = Measurement lag value of bank stability; NIM = Net Interest Margin; Market Power (MP) = measurement of bank competition; ForP = Foreign bank penetration; Foreign Own = Foreign bank ownership; Govt Own = Government ownership; SFOC = Business sector loan diversification; TFOC = Type of loan facility diversification; RFOC = Diversification of interest income and non-interest income; NFOC = Diversification within non-interest income; NNON = Net non-interest income; FEE = Income from fee and commission measured by ratio of fee and commission income over total assets; TRADING = Income from trading measured by ratio of trading income over total assets; MP*RFOC = Interaction between variables MP and RFOC; MP*SFOC = Interaction between variables MP and SFOC; NIM*MP = Interaction between variables NIM and MP; NIM*SFOC = Interaction between variables NIM and SFOC; NIM*TFOC = Interaction between variables NIM and TFOC; NIM*RFOC = Interaction between variables NIM and RFOC; NIM*NFOC = Interaction between variables NIM and NFOC; Size Assets = Size of bank assets; LTA = Size of loan portfolio, measured by ratio of loan to total assets; LIQ = Liquidity, measured by ratio of liquid asset over total assets; CRISK = Ratio of loan loss provision over total loan; EFF = Ratio of total operational costs over total revenue; DEPCUR = Depreciation of currency in each country; GDPG = Economic growth rate in each country ; INF = Inflation rate in each country. Indonesia is a benchmark country, year dummies are not shown in the table because of limited space. The p-values are shown in the parentheses; ***, ** and * denote significance at 1%, 5% and 10% levels respectively. Dynamic model apply system GMM, use 1 step estimation, t statistic robust standard error.

for the static and dynamic estimations respectively. Columns 1, 2 and 4, and columns 5, 6 and 8 apply the linear market structure of Lerner Index (LI). In this study, the impact of foreign ownership on bank risk was also examined and the results are summarised in columns 2 and 5. The results of the non-linear market structure are displayed in columns 3 and 7. The interaction between market power (MP) and diversification of loan and revenue, market power (MP) and net interest margin (NIM) as well as interaction between NIM and diversification of loan and revenue, are provided in columns 3, 4, 7 and 8. The diversification revenue measurement (NNON), categorised into fee and commission and trading are shown in columns 3 and 7.

4.2.1 Net Interest Margin (NIM)

Static panel data regressions of net interest margin (NIM) indicate that it has a positive significant impact on the level of banking stability or risk level (Z score). The greater the level of the intermediation margins, the lesser the possibility of the bank becoming insolvent. A higher NIM coefficient implies that banks in ASEAN-4 have a higher dependence on interest margins to maintain their financial stability. The interest margin is expected to increase bank profits which can buffer banks from macroeconomic shocks and shocks due to liquidity problems (Boyd & De Nicolo, 2005; Uhde & Heimeshoff, 2009). These findings confirm the results of several studies (see Fu et al., 2014; Uhde & Heimeshoff, 2009).

In contrast to the long-term equilibrium (static model), it is found that NIM does not affect the stability of the banking system in the short-term period (dynamic period). This may be because an insufficient portion of NIM was converted into capital as a buffer of risks. It probably occurred because the banks offered lower interest rates to attract new customers thus, the profits had been eroded by higher banking operational costs. These results are consistent with the findings of Fu et al. (2014) who focused on banking stability in several countries in Asia Pacific.

4.2.2 Bank Competition

The degree of bank competition or market power (MP) measured by Lerner Index (LI) shows a significant positive correlation with the Z score. This implies that the higher the MP, the higher the profit produced, whether from interest income or from exploiting the MP to diversify and

differentiate the products (Fu et al., 2014; Valverde & Fernandez, 2007). The high profits can be used to lower both systematic and unsystematic risks arising from the bank's operations. Thus, it can be concluded that the increased MP in ASEAN-4 has an impact on improving the banking stability. This is consistent with the "competition fragility" view (Beck et al., 2013; Keeley, 1990). The findings thus confirm the empirical results noted by other studies (see Fu et al., 2014; Ariss, 2010).

This study also tested but does not find a non-linear relationship between the degree of bank competition with the level of risk as proposed by Martinez-Miera and Repullo (2010), Berger et al. (2009) and Jimenez et al. (2013).

4.2.3   Diversification

The diversification of the credit portfolio into various business sectors (SFOC) exhibited a negative correlation with the Z score but this association is not significant. However, if banks focused on a few particular types of credit products (TFOC – investment credit, working capital, consumer credit), their insolvency risks can be lowered. This implies that focused banks can utilise their management expertise to improve profits. Expertise is required to screen credit proposals and this usually leads to a higher degree of profitability and banking stability (Acharya, 2006). Predictably, a bank can impose different interest rates on products, based on their levels of risk thus, riskier credit products such as credit investment may generate higher income than working capital loans.

Another diversification index pertains to the type of income (RFOC). This variable is negatively correlated with the Z score, both in the long run equilibrium and short-term dynamics. This means that the banks' revenue diversification enables the banks in ASEAN-4 to improve their performance and the Z score, in line with other studies (Stiroh & Rumble, 2006; Nguyen, Skully, & Perera, 2012b; Edirisuriya et al., 2015). The diversification to non-traditional products is done with the purpose of cross-subsidising a decrease in interest margin but also to increase banking profits. Banking revenues derived partly from the sale of non-traditional products have been used to effectively cushion against the risk of bank failures.

Commissions and fee income (FEE) generated from the sale of non-interest income products are positively correlated with banking stability. This type of income seems strong enough to boost bank profits

in the long run while lowering the level of risk. This is in accordance with the findings obtained by Martinez-Miera and Repullo (2010) and Mercieca et al. (2007).

Meanwhile, revenue from trading (TRADING) leads to lower level banking stability. It appears that in general, banks in ASEAN-4 do not have high expertise in conducting higher-risk trade transactions, relative to their capability to sell their main products that generate interest income. In the long run, banks that shift their activities to sales of trading products face increased risk. This is consistent with the findings in Kwast (1989), Stiroh (2004) and DeYoung and Torna (2013)

4.2.4 *Combined Effect of Market Power and Revenue Diversification Strategy*

This study also tested the combined effect of the following on banking stability: (a) market power (MP) and diversification strategy in business sector loan (SFOC); (b) market power (MP) and revenue diversification strategy (RFOC); (c) interaction of NIM and market power (MP); (d) the combined effect of NIM and diversifications in loans (SFOC and TFOC); and (e) interaction of NIM and revenue diversification (RFOC and NFOC). The relationships between the Z score with MP and RFOC are positive and negative respectively. However, the interaction variable between MP and RFOC shows a positive relationship with the Z score, indicating that a bank with higher market power enjoys higher stability when its revenue diversification is low. Banking stability is predominantly influenced by market power rather than exploitation of the market power to generate income from non-interest income. The combined effects between MP and SFOC and NIM and MP do not significantly affect banking stability. However, the interaction between NIM and SFOC shows negative stability suggesting that banks that are less diversified (focus) on the business sector loan (SFOC) have lower banking stability. The combined effect of NIM and banks' focus on certain types of loans (TFOC) can strengthen banking stability while the combined effect of NIM and banks' focus on certain types of revenue (RFOC) can lead to banking instability.

4.2.5 *Foreign Bank Penetration*

Foreign bank penetration (ForP) shows a positive and significant relationship with the level of banking stability (Z score) indicating that the high intensity foreign banks apply on their asset expansion

is effective in increasing banking stability. ForP has been shown to increase market power or decrease market competition. Nonetheless, despite having the pricing power, foreign banks can also reduce interest margins. With their expertise in sales of non-traditional products, foreign banks can improve profits and charter value which lowers bank risks. Foreign banks also have better knowledge in screening information and in analysing the borrowers' credit risks; they have tighter credit policies and require higher collateral values (Claeys & Hainz, 2014); they only extent loans to higher credit-worthy companies such as multi-national corporations, large domestic companies and governments hence, foreign banks trigger "cream skimming". They only select credit-worthy borrowers (Detragiache, Tressel, & Gupta, 2008; Berger et al., 2009). Consequently, foreign banks are able to mitigate credit default risks better than local banks.

4.2.6 Bank Specific Variables

Bank-specific variables that have a significant link with banking stability are the size of bank assets (Size Assets) and cost efficiency (EFF). In comparison, credit portfolio (LTA), bank liquidity (LIQ) and credit risk (CRISK) have no significant effect on banking stability in ASEAN-4. Results noted in all the columns showing short-term and long-term stability indicate a negative relationship between the size of a bank's assets with the Z score. Larger-sized banks tend to take excessive risks which might be caused by their desire to expand in order to retain control over the market. This increased risk may possibly be due to the consolidation exercises carried out by some foreign banks through mergers and acquisitions of troubled banks. The results of this study confirm the findings of previous studies such as Fu et al. (2014) and Soedarmono et al. (2013). Soedarmono et al. find that large banks have a tendency to fail, as observed in some Asian countries. The concentration of financing in some large banks and the safety net programmes offered by some government as well as the "too big to fail" status can create weak credit cultures and morale hazard problems. This can increase bank risks (Mishkin, 1999; Williams, 2016).

This study also finds that bank efficiency (total costs/total revenues) correlates positively and significantly with banking stability. This implies that inefficient banks in ASEAN-4 tend to be more cautious in taking risks, a condition which may have been caused by thin profit margins which also provide less reserves for the capital as a buffer

for risks. The findings of this study are consistent with the results of Altunbas et al. (2007) who focused on European banking industry as well as the findings of Berger and DeYoung (1997) who note that the cost of inefficiency in banking operations have caused risk-averse managers to avoid risky portfolios.

4.2.7 Macroeconomic Variables

The macroeconomic variables incorporated into the model employed in this study are economic growth rate (GDPG), inflation (INF) and currency depreciation (DEPCUR). The findings show that these variables are not associated with banking stability (see Uhde & Heimeshoff, 2009; Fu et al., 2014). However, Soedarmono et al. (2013) note that there is weak positive correlation between GDPG and banking stability, revealing that a stable inflation rate may not affect the movement of risk measurement.

4.2.8 Dummy Variables

The regression results tabulated in Tables 3, 4 and 5 indicate that the foreign ownership dummy consistently has a positive relationship with banking stability, indicating that foreign banks are more cautious in risk taking than local banks. It also seems that government banks have lower stability and that higher loans by non-performing government banks could be due to the effects of higher risk taking instances, political decisions to finance non-profitable business projects, the distribution of government credit programmes with low interest rates and higher risk loan defaults (La Porta, Lopez-de-Silanes, & Schleifer, 2002). Despite these findings, it is observed that the association between foreign ownership, government ownership and banking stability is not significant.

Tables 3, 4 and 5 also display the country dummies, with banking in Indonesia set as the benchmark. It is observed that, unlike Indonesian banks, Thai banks and Malaysian banks have higher stability. Thailand's banking system is found to be the most stable during this period (2006-2012) followed by the Malaysian, Indonesian and Philippine banking systems. Meanwhile, for year dummies (not shown in the tables but available upon request) where year 2006 was used as the based year, it is observed that the period between 2011 and 2012 was more stable than 2006; banking stability in year 2008 was significantly lower than year 2006.

Table 4: Robustness Test Static Models of Determinant Z Score

	Market Power (MP) HHI			Market Power (MP) CR3		
	1	2	3	4	5	6
NIM	172.3870***	152.3100***	169.6970***	172.1720***	152.5990***	173.0690***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market Power (MP)	4.4479**	4.5730*	15.8516	9.4266*	9.9474**	-129.1230
	(0.036)	(0.031)	(0.197)	(0.056)	(0.044)	(0.248)
Market Power (MP)^2			-11.4600			81.6174
			(0.345)			(0.215)
ForP	18.6361***	18.2417***	18.2452	20.4533***	20.1706***	7.8897
	(0.001)	(0.001)	(0.001)***	0.000	0.000	(0.493)
SFOC	-3.2934	-3.5585	-3.1197	-3.3496	-3.6027	-3.4094
	(0.221)	(0.187)	(0.249)	(0.215)	(0.183)	(0.207)
THOC	8.2519***	7.7563**	8.3941***	8.2525***	7.7434**	8.5613***
	(0.009)	(0.014)	(0.008)	(0.009)	(0.015)	(0.007)
RFOC	-7.4255**	-8.4397**	-7.6250**	-7.4316**	-8.4861**	-8.0007**
	(0.038)	(0.019)	(0.034)	(0.039)	(0.019)	(0.027)
NFOC	-1.9913	-1.0970	-2.1946	-2.0945	-1.1986	-2.1046
	(0.376)	(0.630)	(0.332)	(0.355)	(0.600)	(0.352)
NNON	19.2747		17.9079	18.3777		20.1607
	(0.554)		(0.583)	(0.573)		(0.537)
FEE		120.3120*			122.6050**	
		(0.035)			(0.032)	
TRADING		-57.0233**			-58.0592**	
		(0.031)			(0.029)	
Size Assets	-1.3864***	-1.5898***	-1.4266***	-1.3736***	-1.5792***	-1.4099***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LTA	-1.5626	-1.3989	-1.9820	-1.4861	-1.3602	-1.6328
	(0.636)	(0.663)	(0.552)	(0.653)	(0.672)	(0.622)

LIQ	0.3004	-2.5457	-0.2420	0.1091	-2.7764	-0.1858
	(0.963)	(0.700)	(0.971)	(0.987)	(0.675)	(0.977)
CRISK	9.5884	17.2896	9.9270	9.8304	17.3735	8.6991
	(0.616)	(0.298)	(0.605)	(0.609)	(0.298)	(0.651)
EFF	4.9748	3.3067	4.3498	4.8249	3.2107	4.6065
	(0.105)	(0.116)	(0.166)	(0.116)	(0.128)	(0.134)
DEPCUR	-2.9377	-4.9023	-2.7371	-2.5749	-4.5676	-0.6490
	(0.676)	(0.492)	(0.698)	(0.715)	(0.523)	(0.928)
GDPG	-0.2404	-0.2812	-0.1709	-0.1975	-0.2377	-0.0816
	(0.231)	(0.162)	(0.425)	(0.323)	(0.235)	(0.711)
INF	0.0225	0.0274	0.0317	0.0195	0.0281	-0.0183
	(0.903)	(0.881)	(0.864)	(0.917)	(0.880)	(0.923)
MALAYSIA	5.5818	8.3070	5.4748	5.8121	8.5764	4.4841
	(0.347)	(0.163)	(0.355)	(0.326)	(0.149)	(0.456)
THE PHILIPPINES	0.7091	0.4779	-0.0676	-0.5033	-0.8033	6.6919
	(0.901)	(0.933)	(0.991)	(0.930)	(0.888)	(0.413)
THAILAND	17.5666***	19.1656***	17.2599***	16.1244**	17.6141***	25.0621***
	(0.006)	(0.003)	(0.007)	(0.012)	(0.006)	(0.009)
Constant	36.6283***	42.1332***	36.7119***	31.3366***	36.5575***	85.9996
	0.000	0.000	0.000	0.000	0.000	(0.055)
R^2	0.1911	0.1995	0.1924	0.1893	0.1979	0.1922

Notes: NIM = Net Interest Margin; Market Power (MP) = measurement of bank competition; ForP = Foreign bank penetration; SFOC = Business sector loan diversification; TFOC = Type of loan facility diversification; RFOC = Diversification of interest income and non-interest income; NFOC = Diversification within non-interest income; NNON = Net non-interest income; FEE = Income from fee and commission measured by ratio of fee and commission income over total assets; TRADING = Income from trading measured by ratio of trading income over total asset; Size Assets = Size of bank assets; LTA = Size of loan portfolio, measured by ratio of loan to total asset; LIQ = Liquidity, measured by ratio of liquid asset over total assets; CRISK = Ratio of loan loss provision over total loan; EFF = Ratio of total operational costs over total revenue; DEPCUR = Depreciation of currency in each country; GDPG = Economic growth rate in each country; INF = Inflation rate in each country. Indonesia is a benchmark country, year dummies are not shown in the table because of limited space. The p-values are shown in the parentheses; ***, ** and * denote significance at 1%, 5% and 10% levels respectively.

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Table 5: Robustness Test Dynamic Model of Determinant Z Score

	Market Power (MP) HHI			Market Power (MP) CR3		
	1	2	3	4	5	6
Z Score(-1)	0.7012***	0.6657***	0.7014***	0.6985***	0.6628***	0.6996***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NIM	42.5335	63.0235	42.1950	43.9218	64.0796	51.1578
	(0.686)	(0.534)	(0.684)	(0.676)	(0.527)	(0.626)
Market Power (MP)	7.8002	7.4090	5.1830	17.5071	16.1726	-113.5480
	(0.211)	(0.218)	(0.883)	(0.240)	(0.265)	(0.639)
Market Power (MP)^2			2.5493			77.8510
			(0.941)			(0.580)
ForP	20.6589	26.8752	20.9941	22.9046*	28.9160*	11.0561
	(0.135)	(0.076)	(0.150)	(0.090)	(0.051)	(0.663)
SFOC	-5.3828	-4.1145	-5.3960	-5.4062	-4.1605	-5.5051
	(0.560)	(0.684)	(0.556)	(0.556)	(0.680)	(0.552)
TFOC	10.1153	9.3810	10.0494	10.2875	9.4563	10.5692
	(0.234)	(0.298)	(0.241)	(0.227)	(0.294)	(0.217)
RFOC	-24.4648**	-26.8988**	-24.4822**	-24.2099**	-26.6795**	-25.4830**
	(0.021)	(0.014)	(0.020)	(0.022)	(0.014)	(0.019)
NFOC	-5.4943	-3.7692	-5.3521	-5.9940	-4.1596	-5.8909
	(0.346)	(0.546)	(0.352)	(0.302)	(0.500)	(0.315)
NNON	-30.8732		-31.1284	-31.0631		-24.1092
	(0.807)		(0.803)	(0.806)		(0.849)
FEE		171.0230			169.9870	
		(0.474)			(0.479)	
TRADING		-80.7817			-80.5747	
		(0.470)			(0.473)	
Size Assets	-1.1978**	-1.3209**	-1.1979**	-1.1714**	-1.2920**	-1.1919**
	(0.022)	(0.021)	(0.022)	(0.025)	(0.022)	(0.020)
LTA	-13.3176*	-15.6412**	-13.2352*	-13.5125*	-15.7957**	-13.7467*
	(0.075)	(0.046)	(0.067)	(0.073)	(0.047)	(0.070)

LIQ	38.7234	36.3718	38.6609	39.2386	36.7120	38.8380
	(0.134)	(0.176)	(0.137)	(0.133)	(0.175)	(0.140)
CRISK	-86.4939	-95.8246	-88.7275	-78.8416	-89.8550	-76.9256
	(0.426)	(0.368)	(0.437)	(0.470)	(0.399)	(0.476)
EFF	5.9266	6.8583	5.8955	5.9029	6.8073	6.4294
	(0.394)	(0.269)	(0.385)	(0.393)	(0.275)	(0.345)
DEPCUR	-6.4363	-13.7607	-6.5420	-5.7474	-12.7559	-3.0153
	(0.671)	(0.377)	(0.674)	(0.699)	(0.404)	(0.850)
GDPG	-0.0949	-0.2610	-0.1123	-0.0355	-0.1944	0.1074
	(0.817)	(0.543)	(0.809)	(0.929)	(0.643)	(0.827)
INF	0.3593	0.4366	0.3589	0.3467	0.4163	0.3132
	(0.288)	(0.212)	(0.286)	(0.289)	(0.221)	(0.348)
MALAYSIA	10.9560	13.0816*	11.0382	11.2195	13.3576*	9.9795
	(0.118)	(0.087)	(0.118)	(0.110)	(0.079)	(0.197)
THE PHILIPPINES	-1.4750	-0.5873	-1.3959	-3.6122	-2.5636	3.4868
	(0.871)	(0.950)	(0.883)	(0.712)	(0.798)	(0.827)
THAILAND	12.7163*	13.7922*	12.8476*	9.9037	11.2540	17.9572
	(0.084)	(0.057)	(0.094)	(0.211)	(0.146)	(0.246)
Constant	37.9634**	40.7560**	38.2602**	27.8113*	31.3914*	78.1092
	(0.039)	(0.036)	(0.037)	(0.091)	(0.078)	(0.399)
Wald(joint)	[0.000]**	[0.000]**	[0.000]**	[0.000]**	[0.000]**	[0.000]**
Sargan test	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]
AR(1) test	[0.017]*	[0.015]*	[0.017]*	[0.017]*	[0.015]*	[0.018]*
AR(2) test	[0.984]	[0.939]	[0.981]	[0.974]	[0.921]	[0.990]

Notes; Z score(-1) = Measurement lag value of bank stability; NIM = Net Interest Margin; Market Power (MP) = measurement of bank competition; ForP = Foreign bank penetration; SFOC = Business sector loan diversification; TFOC = Type of loan facility diversification; RFOC = Diversification of interest income and non-interest income; NFOC = Diversification within non-interest income; NNON = Net non-interest income; FEE = Income from fee and commission measured by ratio of fee and commission income over total assets; TRADING = Income from trading measured by ratio of trading income over total assets; Size Assets = Size of bank assets; LTA = Size of loan portfolio, measured by ratio of loan to total assets; LIQ = Liquidity, measured by ratio of liquid asset over total assets; CRISK = Ratio of loan loss provision over total loan; EFF = Ratio of total operational costs over total revenue; DEPCUR = Depreciation of currency in each country; GDPG = Economic growth rate in each country ; INF = Inflation rate in each country. Indonesia is a benchmark country, year dummies are not shown in the table because of limited space. The p-values are shown in the parentheses; ***, ** and * denote significance at 1%, 5% and 10% levels respectively. Dynamic model apply system GMM, use 1 step estimation, t statistic robust standard error.

4.3 Robustness Check

To check the robustness of the empirical results, competition measurement from the degree of market power (Lerner Index-LI) taken from each bank was substituted with market concentration ratio of Herfindahl-Hirschman Index (HHI) and bank concentration ratio (CRn). Concentration of loan portfolios was used as the HHI measurement and the concentration of three biggest banks' loan portfolios was used as the CR3 measurement.

Tables 4 and 5 show the robustness results gained from the regression. In general, the results indicate a consistent relationship between competition measurements (HHI and CR3) and banking stability (Z score), as well as the relationship between NIM, measurement of diversifications, bank specific variables, macroeconomic variables and banking stability. Non-linear relationship between the degree of competition and banking stability is not found. This may be due to the different measurements of market structure used in this study, unlike Martinez-Miera and Repullo (2010) who used a number of banks (log number of banks) as a measurement for competition. In addition, the results in this study could have been caused by the different competitive structures of the banking industry in ASEAN-4, compared to the same industry of developed countries. It appears that the structure competition of the banking industry in ASEAN-4 is very dynamic; it changes over time. According to Jeon, Olivero, and Wu (2011), several factors could have been the influence. These factors include the deregulation of the banking sector, their privatisation effort, advanced information technology in the banking sector and the internationalisation of financial capital markets. From these factors, it is deduced that the dynamic competition structure in ASEAN-4 has a different effect on banking stability.

5. Conclusions

A decreasing trend in interest margin followed by an increasing market power as well as enhanced banking activities to sell non-traditional products can raise the concerns of bank risks or banking stability. This study has attempted to evaluate these issues: the impact of the level of interest margin, market power, diversification strategy and foreign bank penetration on the overall bank risks or banking stability of ASEAN-4. The empirical results emphasised that the level of NIM is an important factor in determining the banking stability of ASEAN-4. However,

this finding is not surprising because bank intermediation margins are relatively higher when compared to the banking system of developed countries (Bustaman et al., 2016). Other factors that contribute to an increased banking stability are market power, diversification of non-interest income and focus (less diversified) on certain types of loans as well as foreign bank penetration.

Revenue diversification has possibly subsidised the decreasing income of traditional loan products which acts to stabilise bank profits. When non-interest income variables are decomposed, the commissions and fee income would positively contribute to an increased banking stability in the long run. However, income from trading activities increases bank risk which suggests that the banking industry in ASEAN-4 requires experts to manage these trading products. Having a better knowledge in specific types of loan products can create more specialised bank services which, in turn, allows such banks to charge a higher margin thereby, lowering the risk of bank failure.

Banking consolidation exercises such as mergers and acquisitions increase the market power of individual banks in the region. This positively impacts the banking stability. Predictably, banks have exploited their market power to diversify and differentiate their products. A higher income from the diversification of loans and products can contribute to the capital reserves hence, lowering the risk level of both systematic and unsystematic risks arising from the bank's operations. An increase in market power in ASEAN-4 improves the stability of the banking industry; this is consistent with the "competition fragility" view (Beck et al., 2013, Keeley, 1990). However, this study could not prove that there is a non-linear relationship between the degree of competition and banking stability. Furthermore, as predicted by some banking literatures in emerging countries (Yeyati & Micco, 2007; Allen, Jackowicz, Kowalewski, & Kozlowski, 2017), foreign bank penetration has already improved the banking stability in ASEAN-4.

The findings of this study reveal that larger banks tend to take higher risks probably because of their ambition to retain control of the market power. Other possible roots of the problems are: a larger bank is the product of mergers and acquisitions of some troubled banks; and government subsidies and benefits towards banks with "too big to fail" status can create morale hazard problems for the manager who may need to take on excessive risks. Another specific bank variable that positively affects banking stability is efficiency: an inefficient bank does not equate to a high-risk bank. Inefficient banks are run conservatively

because they have limited margin and capital reserves; this constrains them from taking a higher level of business risks.

The results of this study have several implications for players in the banking industry. Increased bank market power in ASEAN-4 is possibly due to the process of banking consolidation by foreign banks and larger banks. Such a market power has been noted to increase banking stability. However, it can also create inefficient banks and cartel-formations between larger banks that control the market price of interest rate and other fees. In that regard, regulators need to deregulate some rules such as those concerning foreign bank ownership, to dismantle any overt or covert efforts at cartel-formation that are manifested in the inadequate competition of bank rates. This can be resolved by encouraging better competition among the players in the banking industry. At the same time, the banking microeconomic conditions such as bank efficiency must be enhanced. It is noted that inefficient banks do not enjoy higher bank interest margin in ASEAN-4; these banks do not have enough capital reserves to act as buffer for higher risks. However, the larger banks have the tendency to take excessive risks which results in an increase in banking instability. In this regard, some policies related to the government's safety net and the government's practice of protecting larger banks must be reviewed. Increasing banks' non-traditional business activities, specifically income from commissions and fees can help to subsidise interest margins and buffer banking failures. However, banks must exercise prudence when effecting trading activities as the lack of expertise in these activities may also increase banking instability.

Lastly, this research is expected to contribute to the knowledge of banking. By combining the effect of interest margin, market power and revenue diversification and loan portfolio diversification simultaneously, on banking stability, especially for ASEAN-4 market, this study has shown that banking stability can be achieved. There are several limitations experienced by this study. First, this study did not specifically examine whether diversification in banking business increases during the crisis period or deteriorates banking stability in ASEAN-4. However, the effect of the crisis year is captured by running the model using time fixed effect. Second, this study applied common practices in the measurement of banking stability namely, the Z score, to measure distance to default. This measurement is supported by the book value of accounting numbers. However, future studies may use a combination of data from capital market capitalisation of the bank's assets and bank's market stability to measure the modified Z score,

as applied by Edirisuriya et al. (2015), as a means to obtain valuable market feedback.

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