Bank market power and revenue diversification: Evidence from selected ASEAN countries

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ABSTRACT

This paper examines the association between bank market power and revenue diversification using a sample of 153 commercial banks from five Association of Southeast Asian Nations (ASEAN) member countries (Indonesia, Malaysia, the Philippines, Thailand and Vietnam). We find a non-linear relationship between bank market power and revenue diversification, where at lower degrees of market power (in loan and deposit markets) banks concentrate on revenue diversification. In contrast, those with greater market power focus more on traditional interest-based products. Our findings also indicate that credit losses experienced earlier, during and after the Asian financial crisis have encouraged ASEAN banks to diversify into non-traditional activities to compensate for their excessive losses. When the markets recovered and loan demand increased, however, traditional interest-based business has become more important. These results remain consistent across all models providing robust results.

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1. Introduction

In the context of financial deregulation and liberalization the world banking system faces major changes through increased competition, concentration and restructuring. Banks have responded by broadening their business to include non-traditional services. Non-interest income activities, such as loan origination, securitization, standby-letters of credit and derivative securities, have rapidly expanded thereby dramatically increasing this income.

Prior studies on bank non-interest income cover the U.S. (Clark & Siems, 2002; DeYoung & Rice, 2004; Jagtiani, Nathan, & Sick, 1995; Rogers & Sinkey, 1999), Europe (Carbó-Valverde & Rodríguez-Fernández, 2007; Lepetit, Nys, Rous, & Tarazi, 2008b), Mexico (Maudos & Solís, 2009), Taiwan (Lieu, Yeh, & Chiu, 2005) and 87 advanced, transition and less-developed countries (Lozano-Vivas & Pasiouras, 2010). The latter concludes that the exclusion of non-traditional activities in bank efficiency estimations leads to a misspecification of bank product frontiers. Collectively, these studies highlight the growing contribution of non-traditional income to banking literature.

Despite the increasing presence of bank non-interest income both theoretically and practically, scant attention has focused on which bank characteristics, industry and/or market conditions are associated with an increase in non-interest

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income. While large banks and those with technological advances (e.g., the Internet and ATMs) extract more non-interest income than small banks (DeYoung & Rice, 2004; Rogers & Sinkey, 1999), there is little systemic understanding of why non-interest income varies across banks. Motivated by these knowledge gaps, our research contributes to the literature by modelling the influence of bank market power on non-interest income.

While prior research on market power focuses primarily on bank net interest margin (Maudos & Fernández de Guevara, 2004; Williams, 2007), financial stability (Agoraki, Delis, & Pasiouras, 2011; Jiménez & Saurina, 2004), bank efficiency (Brissimis, Delis, & Papanikolaou, 2008; Delis & Tsionas, 2009; Turk-Ariss, 2010) and bank regulations (Agoraki et al., 2011; Beck, Demirgüç-Kunt, & Levine, 2006; Fonseca & González, 2010), attention has not been given to non-interest income. We argue that its impact is important because market power helps banks identify new non-traditional growth opportunities and delivers greater bargaining capacity with their customers.

Our study contributes to the existing literature in several ways. Most importantly, it combines two independent streams of academic research (i.e. (1) effect of bank market power and (2) revenue diversification[3]) and examines whether bank market power in lending and deposit markets manifests in higher non-traditional income after controlling for other bank-specific and country-level factors.

It also investigates whether the association between market power and revenue diversification is non-linear. Our rationale is as follows. As bank market power increases, managers may have fewer incentives to diversify their revenue because their capacity to price above marginal cost already generates sufficient profits. Lending specialization may also provide informational advantages and so lower intermediation costs and increase bank profits (Berlin & Mester, 1999; Boot & Thakor, 2000; Carbó-Valverde & Rodríguez-Fernández, 2007; Petersen & Rajan, 1995). Similarly, banks successful in traditional interest-based markets may seek long-term relationships with their customers. Once a lending relationship is established, the marginal cost of additional loans is limited to interest expenses and thus allows economies of scale (DeYoung & Roland, 2001; Lepetit, Nys, Rous, & Tarazi, 2008a).

We further perceive that the two independent streams of academic research (i.e. (1) effect of bank market power and (2) revenue diversification) have been extensively examined for advanced countries (predominantly for the U.S. and Euro area). Their findings, however, may not apply to emerging/developing banking markets. This is because most operated as repressed financial sector in the 1980s and have since undergone significant changes and developments (Agoraki et al., 2011; Turk-Ariss, 2010). As such economies have specific characteristics that differ from those of industrialized countries; a proper and separate modelling is required (Aleem, 2010; Frankel, 2010).

In selecting an appropriate sample, we are attracted to the unique bank restructuring and regulatory changes implemented by Association of Southeast Asian Nations (ASEAN) member countries following the Asian financial crisis (AFC) in 1997–1998. Indonesia and Thailand, for example, suffered considerable losses during the AFC and, together with Malaysia and the Philippines, have extensively changed their financial architecture (Cook, 2008; Soedarmono, Machrouh, & Tarazi, 2011). Vietnam, as part of its economic transition, also restructured its banking system (Soedarmono et al., 2011). In addition, as members of ASEAN, these countries have had to adopt international standards in banking supervision and regulations (i.e. capital adequacy, loan classification and loan loss provisioning) and to remove many of their prior restrictions on establishing new banks, on opening new branches and on foreign bank penetration (Lindgren et al., 2000; Williams & Nguyen, 2005). Understandably, such increased regulatory focus and the resulted heightened competition may place extra pressure on ASEAN banks and encourage revenue diversification strategies in order to maintain their future cash flows and franchise values.

This increasing importance of non-interest income in these ASEAN commercial banks is well documented in regulatory publications (Bangko Sentral ng Pilipinas, 2008; Bank Indonesia, 2008). Empirical research on their associated bank characteristics (specifically market power), market and country conditions, however, is lacking. At the same time, there is no cross-country comparison in the ASEAN context. We argue that such regional focus is essential as these ASEAN countries have integrated further intra-regional trades and economic agreements. Our sample, therefore, consists of 153 commercial banks operating in five ASEAN member countries (Indonesia, Malaysia, the Philippines, Thailand and Vietnam) during 1998–2008. It should help investigate how such important structural changes (banking competition, industry concentration, regulatory and macroeconomic conditions) affect the evolution of ASEAN banks' non-interest income. The sample period also helps examine the association between bank market power and revenue diversification in the light of the turbulent aftermath of the AFC and the onset of the Global financial crisis (GFC). This period also allows to identify whether changes in the degree of bank market power have affected banks' revenue diversification strategies over time.

Our results indicate that the association between market power and revenue diversification is non-linear; suggesting that at lower degree of market power (in loan and deposit markets), banks focus more on revenue diversification. Banks with greater market power, however, concentrate more on traditional interest-based products. We also find that ASEAN banks' interest income grows faster than their fee and commission income during economic booms. During recession, however, non-traditional banking products become more important. Banks with higher capital ratios also appear to have higher levels of non-traditional activities. Foreign-owned, large and well-capitalized banks as well as those with Islamic bank subsidiaries

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[3] By revenue diversification, we mean that banks seek to grow their revenue base from additional sources of non-interest income (such as loan origination, securitization, stand-by letter of credit and derivative securities).

Table 1
Domicile of sample banks and their composition (as of December 2008).

	Indonesia	Malaysia	Philippines	Thailand	Vietnam
No of commercial banks[a]	67	26	12	21	27
Of sample banks					
State-owned	3	0	1	2	3
Private-owned	64	26	11	19	24
Foreign-owned (>50% shares)	16	13	6	5	0
Domestic-owned	51	13	6	16	27
Listed	22	5	8	10	2
Non-listed	45	21	4	11	25

Source: Compiled by authors from respective central bank reports and BankScope.
Note: This table details the number of commercial banks in five ASEAN countries: Indonesia, Malaysia, Philippines, Thailand and Vietnam and their composition.
  [a] Number of commercial banks after excluding foreign branches that do not produce separate financial reports.

have a greater proportion of non-interest income.[4] The country-specific variables also show that bank revenue diversification is hindered by activity restrictions on the industry. After excluding the crisis years (1998 and 1999 due to the AFC and 2007 and 2008 due to the GFC), our results remain consistent for all proxies of market power.

The remainder of this paper is structured as follows. The sample and methodology are explained in Section 2. Section 3 presents the main empirical results. The article concludes in Section 4.

2. Sample and method

2.1. Sample

The sample consists of 153 commercial banks operating in five selected ASEAN countries (Indonesia, Malaysia, the Philippines, Thailand and Vietnam) over 1998–2008. The other five ASEAN members are excluded: Singapore due to its respective developed status[5] and accounting report date mismatch; Cambodia due to heightened restrictions and prohibitions covering commercial banks' non-interest income activities (Barth, Caprio, & Levine, 2004) and lack of bank-specific data (only 23 bank-year observations over the 11-year sample period are available); and Brunei, Laos and Myanmar because of lack of data to calculate market power indices and accounting report date mismatch. Specifically, the total numbers of bank-year observations over the sample period in Brunei, Laos and Myanmar are 20, 16 and 28, respectively.

To ensure comparability, other entities, such as investment banks, savings banks, cooperative banks and other non-bank financial intermediaries (insurance companies, mortgage houses, etc.) are excluded as their regulatory requirements differ from commercial banks (Perera, Skully, & Wickramanayake, 2007). In the case of mergers and acquisitions, the target and acquiring firms are treated separately as long as they report separately. If a non-bank acquirer is involved and unconsolidated data are not available after the merger, the target firm is then eliminated from the sample. To avoid survivorship bias, unbalanced bank-specific panel data are used to cover as many banks as possible including those not operating over the whole 10-year sample period 1998–2008.

The domicile and ownership of the sample banks are provided in Table 1. Of the 153, 43.79% are from Indonesia due to its relatively large number of banks. In terms of ownership, most are domestic- and privately owned. Overall, the sample consists of 992 bank-year observations over the period 1998–2008.

The data come from a number of sources. Unconsolidated bank-level information (in US dollars) is from the *BankScope* database published by Fitch Ratings and Bureau van Dijk. The country-specific macroeconomic variables are obtained from International Monetary Fund's (2009) *International Financial Statistics* (IFS). The Index of Economic Freedom (IEF) is collected from the Heritage Foundation and *the Wall Street Journal*. The aggregate banking industry statistics used to calculate industry-specific variables are sourced from the respective central bank annual reports. The market structure details are obtained from the World Bank's World Development Indicators (WDI) and Barth et al. (2004) and Barth, Caprio, and Levine (2006, 2008).

2.2. Method

This sub-section explains the model, measures of revenue diversification, measures of bank market power, and our bank-, industry- and country-specific control variables.

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  [4] Controlling for Islamic bank subsidiaries is important because the basic characteristic of an Islamic banking system is the prohibition of interest-based transactions (Karim, 2001). For Islamic banking, income is supposed to be non-interest income generating from number of activities such as fee, service charge and foreign exchange activities. Therefore, theoretically, banks that establish Islamic bank subsidiaries, ceteris paribus, will generate more non-interest income than other banks.
  [5] Industrialized countries (i.e. Singapore) have experienced varying regulatory reforms and economic transitions from that of emerging economies. Hence, their analysis requires a model specification different from that of developing nations (Aleem, 2010).

Table 2
Variable definitions – Eq. (1).

Variable	Proxy	Definition
Panel A: Dependent variable		
RD	Total non-interest income	Total non-interest income/total assets
Panel B: Bank-specific variables		
FUND_LERNER	Funding-adjusted Lerner index (+)	Bank's ability to price above its marginal cost
L_SHARE	Bank specialization in the loan markets (+)	Total bank loans divided by total financial sector loans
D_SHARE	Bank specialization in the deposit markets (+)	Total bank deposits divided to total financial sector loans
BANKSIZE	Bank size (+)	Natural log of bank total assets
EFFICIENCY	Bank cost efficiency (−)	Ratio of total cost to total income
NPL	Ex-post credit losses (+)	Loan loss provisions divided by net loans
NIM	Bank interest margin (−)	Net interest income to total earning assets
EQUITY	Bank capitalization (+/−)	Ratio of total equity to total assets
STATE	State ownership (+)	A dummy variable that takes the value of 1 for banks that are 50% or more state owned, each year
DOMESTIC ≤ 50%	Domestic ownership (+/−)	A dummy variable that takes the value of 1 for banks that are 50% or less domestic owned, each year
ISLAMIC_PRODUCTS	Banks with Islamic banking subsidiaries (+)	A dummy variable that take the value of 1 for banks that offering Islamic banking products, each year
LISTED	Listed banks (+)	A dummy variable that take the value of 1 for banks that are listed in stock exchanges, each year
Panel C: Industry-specific variables		
3-k CONCENTRATION	Market concentration (+)	Market shares of the three largest banks
Panel D: Country-specific variables		
BANKING FREEDOM	Openness of the banking sector (+)	Banking freedom
RESTRICTIONS	Activities restrictions (security markets, insurance, real estate and owning shares in non-financial firms) (−)	Takes on values between (1) and (4) for each of the four categories unrestricted (1), permitted (2), restricted (3) or prohibited (4) with index variation between 4 and 16
BUSINESS CYCLE	Effect of business cycle (+)	Annual real GDP growth rate
AFC	Asian financial crisis (−)	Takes on values of 1 for crisis years (1998–1999) and 0 otherwise
GFC	Global financial crisis (−)	Takes on values of 1 for crisis years (2007–2008) and 0 otherwise

Source: Compiled by authors based on theory and prior literature.
Note: This table defines the variables used to estimate the association between bank market power and revenue diversification in selected ASEAN banks during 1998–2008. The expected coefficient signs are given in parentheses next to the variables in bold letters.

2.2.1. The model

The association between bank market power and non-interest income is investigated using the following model:

$$RD_{i,j,t} = \psi + \beta MP_{i,j,t} + \gamma MP_{i,j,t}^2 + \sigma MP_{i,j,t} \times T + \sum_{n=1}^{x} \epsilon_n X_n + \sum_{c=1}^{C} \zeta_c D_c + \varepsilon_{i,j,t} \qquad (1)$$

where the subscripts i, j and t denote individual banks, countries, and time horizon and n indexes the control variables, c indexes dummy variables; RD the share of non-interest income; Ψ a constant; MP the bank-specific market power proxies; T the time trend; X a vector of control variables; D a vector of time dummies to control for time-varying factors; ε a stochastic error term; and β, γ, σ, ϵ, ζ are the parameters to be estimated.

The variable construction and selection are explained in Sections 2.2.2–2.2.4. The detailed variable descriptions are provided in Table 2.

2.2.2. Measure of bank revenue diversification

A bank's non-interest income activities include fee-generating activities, ranging from underwriting to cash management and custodial services (Rogers & Sinkey, 1999). In addition, trading of cash instruments and off-balance contracts as well as mark-to-market changes in the carrying values of assets and liabilities are also non-traditional activities (Stiroh, 2004). As a result, bank revenue diversification (RD) is calculated as the ratio of net non-interest income as a percentage of total assets (Maudos & Solís, 2009). Ideally, non-interest income should be split into fee-based and trading-based income, but this was not available in BankScope.

2.2.3. Measure of bank market power

Bank market power can be proxied by bank performance, Herfindhal Hirschman Index (HHI), k-bank concentration ratio, Panzar–Rosse H statistics and Lerner index. Bank performance, such as the size of the bank margins or profitability, however, is a poor indicator of market power. As the industrial organization theory suggests such proxies can be influenced by a number of bank-specific (i.e. scale of operations and risk preferences) and country-specific factors (i.e. macro performance, the form and degree of taxation of financial intermediation, the quality of the country's information and judicial systems) (Claessens & Laeven, 2004). The HHI and k-bank concentration ratio have also been shown ambiguous indicators of market power because they ignore the relationship between market contestability and revenue at the bank-level (Berger, Demirgüç-Kunt, Levine, & Haubrich, 2004; Berger, Klapper, & Turk-Ariss, 2009). They are also sensitive to differences in the number of banks in each

Table 3
Variable definitions – Eq. (3).

Variable		Definition
Panel A: Dependent variable		
Cost	Total cost	Interest expense + personnel expense + other administration expenses + other operating expenses
Panel B: Independent variables		
Q	Total assets	Total assets
W_1	Unit price of funds	Interest expenses divided by total assets
W_2	Unit price of physical capital	Other administration expenses + other operating expenses divided by total assets
W_3	Unit price of labour	Personnel expenses divided by total assets
Z_1	Fixed assets	Fixed assets
Z_2	Nominal value of off-balance sheet items	Off-balance sheets items
Z_3	Equity capital	Common equity + securities revaluation reserves

Source: Compiled by authors based on theory and prior literature.
Note: This table details the definitions of variables used to derive *MCTA* values from the translog cost function in Eq. (2) for each country.

country and so their choice affects the inferences regarding the degree of competition (Alegria & Schaeck, 2008). Unlike the *HHI* and the *k*-bank concentration ratio, the Panzar–Rosse method utilizes firm-level data and derives a test statistic *H* to capture bank market power (Shaffer, 2004). The empirical implementation *H*-statistic, however, requires banking markets to be in long-run equilibrium which is not always the case in practice (Berger et al., 2009; Soedarmono et al., 2011).

The Lerner index is thus employed here as the proxy of market power. Its computation is based on individual bank observations for each country and so it can overcome small sample bias problem (Jeon, Olivero, & Wu, 2011). It is suited to examine the degree of market power for banks belonging to different ownership types, sizes and specialization (Brissimis & Delis, 2011; Claessens & Laeven, 2004). It also captures the influence of both market concentration and demand elasticity and thus is preferable to market concentration indicators (Maudos & Guevara, 2007). The Lerner index is defined as the disparity between price and marginal cost expressed as percentage of price, taking into account the divergence between product price and marginal cost of production as the essence of monopoly power. It takes the form:

$$\frac{PTA - MCTA}{PTA}.$$

(2)

where *PTA* is the price of total assets calculated as the ratio of total revenues to total assets. *MCTA* is the marginal cost of total assets and is derived from the following translog cost function for each country:

$$\ln Cost = \eta_0 + \eta_1 \ln Q + \frac{\eta_2}{2} \ln Q^2 + \sum_{k=1}^{2} \theta_k \ln W_k + \sum_{k=1}^{2} \vartheta_k \ln Z_k + \frac{1}{2}\sum_{k=1}^{2}\sum_{j=1}^{2} l_{kj} \ln W_k \ln W_j + \frac{1}{2}\sum_{k=1}^{2}\sum_{j=1}^{2} \varphi_{kj} \ln Z_k \ln Z_j$$

$$+ \frac{1}{2}\sum_{k=1}^{2} \kappa_k \ln Q \ln W_k + \frac{1}{2}\sum_{k=1}^{2} \lambda_k \ln Q \ln Z_k + \frac{1}{2}\sum_{k=1}^{2}\sum_{j=1}^{2} \mu_{kj} \ln W_k \ln Z_j + V_1 Trend + \frac{1}{2} \nu_2 Trend^2 + \nu_3 Trend \ln Q$$

$$+ \sum_{k=1}^{2} \phi_k Trend \ln W_k + \sum_{k=1}^{2} \rho_k Trend \ln Z_k + \varepsilon.$$

(3)

where *Cost* is the bank's total costs, including financial costs and operating costs. As a measure of production we use total assets (Q). W_1, W_2 and W_3 indicate the input prices of funds, physical capital and labour, respectively. Z_1, Z_2 and Z_3 represent fixed assets, the total nominal value of off-balance sheet items and equity capital, respectively. A trend (*Trend*) is included to reflect the effect of technical change, which translates into movements of the cost function over time. In line with Turk-Ariss (2010) following interaction terms are included in the translog cost function: $\ln W_k \ln W_j$ (between input prices); $\ln Z_k \ln Z_j$ (between fixed net puts); $\ln Q \ln W_k$ (between output and input prices); $\ln Q \ln Z_k$ (between output and fixed net puts); $\ln W_k \ln Z_j$ (between input prices fixed net puts); $Trend \ln Q$ (trend in output); $Trend \ln W_k$ (trend in input prices) and $Trend \ln Z_k$ (trend in fixed net puts). Cost and input prices are scaled by W_3 and net puts Z_3 to correct for heteroskedasticity and scale bias. The detailed variable definitions for Eq. (3) are provided in Table 3.

Utilizing estimates for Eq. (3), one then derives the *MCTA* as:

$$MCTA = \frac{Cost}{Q}(\eta_1 + \eta_2 \ln Q + \kappa M_W + \nu_3 Trend).$$

(4)

The variables in Eq. (4) remain as defined in Eq. (3). The potential problem with the conventional Lerner index is that the *MCTA* computation using Eq. (4) may reflect some forms of monopoly power in deposit markets (Maudos & Guevara, 2007; Turk-Ariss, 2010). This market power is based on a bank's ability to raise funds at a cheaper cost. When bank managers price loans, they typically cover their funding costs; add a risk premium related to the uncertainty of writing loan contracts and then another premium to reflect the exercise of their market power. So some deposit market power is already incorporated in loan pricing. Maudos and Guevara (2007) and Turk-Ariss (2010) argue that the inclusion of financing costs (W_1) and consequently the price of deposits in the cost function (in Eq. (3)) may bias bank market power studies.

So an improved version (Turk-Ariss, 2010), known as the funding-adjusted Lerner index (*FUND_LERNER*), is utilized. With the funding-adjusted Lerner index, only the operating costs (the price of labour (W_2) and the price of physical capital (W_3)) are considered in the translog cost function given in Eq. (3)) and financing costs (the cost of funds (W_1)) are omitted to obtain a 'raw' proxy of *MCTA*. This proxy is thus free of any deposit market distortions.

After deriving the bank-specific *MCTA* as explained above (which is utilized to estimate Eq. (5) below), the funding-adjusted Lerner index is derived from the following model:

$$\frac{ARTA - MCTA}{ARTA}. \tag{5}$$

where *ARTA* denotes average revenues, or TR/Q (where Q represents total assets), and $TR = TP + TC$. The expected total cost *TC* is derived from Eq. (3) above. The expected total profit *TP* is estimated from the following generic alternative profit function:

$$\ln P = f(\ln Q, \ln W) + \varepsilon. \tag{6}$$

where P is total profits and Q and W denote total assets and input prices, respectively, and the underlying functional form used is the translog specification of Eq. (3) above.

In addition to the funding-adjusted Lerner index described above, as robustness checks, bank-level deposits as a percentage of financial industry deposits (*D_SHARE*) and bank-level loans as a percentage of financial industry loans (*L_SHARE*) are employed as alternative proxies for bank-specific market power (explained in Table 2). These variables are also used in Carbó-Valverde and Rodríguez-Fernández (2007) and Maudos and Solís (2009).

2.2.4. Bank-, dummy, industry- and country-specific control variables

The following bank-, dummy, industry- and country-specific variables are employed as control variables following prior literature. The definitions of these variables and how they are calculated are provided in Table 2.

Bank-specific control variables include bank size, cost efficiency, interest margins, and capitalization. The inclusion of bank size (*BANKSIZE*) follows Lepetit et al. (2008a) who argue that bigger banks tend to have more non-traditional activities, and so earn higher non-interest income relative to smaller banks. Cost efficiency (*EFFICIENCY*) is utilized to capture well-managed banks' ability to reduce bank costs by improving the quality of fee- and commission-based products and to earn higher non-interest revenues (DeYoung & Rice, 2004). Bank interest margin (*NIM*) is expected to influence non-interest income because by setting a lower interest margin, banks can use loan products to establish long-term relationships with their existing customers and/or attract new ones. This allows banks potentially to increase their income from non-traditional activities (Lepetit et al., 2008b).

Bank capitalization (*EQUITY*) is also considered and its coefficient sign is not expected a priori. On the one hand, a negative relationship is documented by Lepetit et al. (2008b) who find that cross-selling different products to core customers allows banks to enjoy relatively lower lending costs. On the other hand, consumers may view lower capital ratio banks as 'too risky' and so seek 'less risky' ones for non-traditional business, influencing these banks' capacity to earn non-interest income (Kishan & Opiela, 2000; Lepetit et al., 2008a, 2008b; Rogers & Sinkey, 1999).

Dummy variables are used to control for different ownership forms (state- versus private-owned, domestic- versus foreign-owned and listed- versus non-listed) and for banks offering Islamic banking products.[6] Arguably, state-owned banks (*STATE*) typically have capacity to generate non-interest income more than private-owned banks because of their greater size, scope and diversification. This is particularly true in ASEAN where governments responded to the AFC by nationalizing banks (Williams & Nguyen, 2005). In addition, state-owned banks may be forced to lend to certain sectors or industries fulfilling other than commercial objectives (Sapienza, 2002). A domestic ownership dummy variable (*DOMESTIC* $\geq$ 50%)[7] is also considered. Its expected sign is not determined a priori. While Berger, DeYoung, Genay, and Udell (2000) find foreign banks have competitive advantages relative to their domestic-owned peers, others observe them at a disadvantage (Havrylchyk, 2006; Lensink, Meesters, & Naaborg, 2008). This may be because local banks have better information about their country's economy, language, laws and politics. *LISTED* is expected to show a positive sign, based on Koutsomanoli-Filippaki and Mamatzakis (2009). They find listed banks in developing countries (like those in ASEAN) are usually among the largest and best performing ones. The *ISLAMIC PRODUCTS* dummy variable distinguishes between banks that have Islamic banking subsidiaries and those that do not. Since banks with Sharia-compliant windows will generate more non-interest income, ceteris paribus, a positive coefficient is expected (Karim, 2001).

With regard to industry-specific variables, we control for bank market saturation using a three bank concentration ratio (*3k-CONCENTRATION*; Agoraki et al., 2011; Claessens & Laeven, 2004; Lepetit et al., 2008a; Schaeck, Cihak, & Wolfe, 2009). Its inclusion also benefits the paper in terms of generalizing of its findings.

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[6] To ensure classification accuracy, ownership details were hand-collected for each bank and each year from respective sample bank's website.

[7] Recall that a bank is indicated as foreign if more than 50% of the total stock of shares is held by non-domestic residents in a particular year (DOMESTIC $\geq$ 50%). In order to test the importance of this assumption, the entire analysis was redone by only including those banks for which more than 70% of the shares are owned by domestic residents. These findings, available upon request, are similar.

Table 4
Mean values of selected variables (1998–2008).

	Indonesia	Malaysia	The Philippines	Thailand	Vietnam
Panel A: Dependent variable					
RD	0.0177	0.0222	0.0164	0.0113	0.0079
Panel B: Bank-specific variables					
FUND_LERNER	0.5419	0.7387	0.4273	0.5713	0.6952
D_SHARE	0.0175	0.0426	0.0242	0.0515	0.0309
L_SHARE	0.0130	0.0303	0.0185	0.0857	0.0150
BANKSIZE	6.0684	7.9080	6.9487	8.5057	5.6817
EFFICIENCY	0.5320	0.4123	0.5195	0.8657	0.3844
NPL	0.9134	0.6340	1.8147	0.0540	0.9905
NIM	0.5081	0.3481	0.5784	0.2312	0.2769
EQUITY	0.1474	0.1302	0.1452	0.1056	0.1209
Panel C: Industry-specific variables					
3k-CONCENTRATION	0.3592	0.3109	0.2723	0.5380	0.5832
Panel D: Country-specific variables					
ENTRY FREEDOM	33.1890	38.5889	46.5217	50.0000	30.0000
RESTRICTIONS	15.4545	10.7272	7.0000	11.3636	14.000
BUSINESS CYCLE	3.3525	4.0906	5.0056	3.5359	7.3993

Source: Computed by authors using data from respective central bank websites, *BankScope*, s World Development Indicators (WDI), Barth et al. (2004, 2006, 2008), International Monetary Fund (2009)'s *International Financial Statistics* (IFS) and the Heritage Foundation and *the Wall Street Journal* (Miles et al., 2011).
Note: This table presents mean values of the variables used to investigate the association between bank market power and income from non-traditional activities for Indonesia, Malaysia, the Philippines, Thailand and Vietnam in 1998–2008. All monetary variables were adjusted for inflationary effects using respective gross domestic product deflator.

The country-specific variables concern bank activity restrictions (*RESTRICTIONS*) banking systems openness (*ENTRY FREEDOM*) and their operating environment (*BUSINESS CYCLE*) that are likely to impact bank diversification.[8] Specifically, *RESTRICTIONS* indicates the regulatory activity restrictions banks face in the securities markets, insurance, real estate and owning non-financial firms.[9] Fewer activity restrictions should provide banks more freedom to focus on those activities most likely to increase shareholder value (Mercieca, Schaeck, & Wolfe, 2007). *ENTRY FREEDOM* indicates the banking system's openness to foreign bank entry and operations as well as governments' influence over bank asset allocation. A positive coefficient is expected for this variable (Mercieca et al., 2007). A positive coefficient is also expected for the GDP growth rate (*BUSINESS CYCLE*) which is used as a surrogate for each country's economic conditions.

3. Empirical results

We first report the mean values of the bank-, industry- and country-specific variables disaggregated by country. A Pearson product moment correlation (for dealing with paired continuous variables) and a Kendall's tau-*b* test (used for pairs with at least one binary variable) are then conducted to examine whether any multicolinearity problems exist. Next, we present the results for the association between bank market power and revenue diversification. Finally, the results of bank-, dummy, industry- and country-specific control variables are outlined.

3.1. Mean values of the data set by country

The mean values of the data set by country for the period 1998–2008 are shown in Table 4. On average, Malaysian banks have the largest non-interest income as a percentage of total assets, accounting for 2.22% whereas Vietnam has the smallest, with 0.79% (Table 4, Panel A). The funding-adjusted Lerner figures (*FUND_LERNER*) show their varying degrees of market power across countries in which Malaysia and Vietnam are as high as 70%. The efficiency ratio (*EFFICENCY*) ranges from 38.44% in Vietnam to 86.57% in Thailand. Vietnam has the largest proportion of loan loss provisions relative to total net loans (*NPL*). Thai banks have the highest ratio of loans to the total financial sector's assets (*L_SHARE*) whereas their equity ratio (*EQUITY*) is the smallest, with 64.84% and 10.56%, respectively (Table 4, Panel B).

Industry-specific variables are shown in Panel C in Table 4. Vietnam and Thailand have relatively more concentrated banking markets with the three largest banks' asset share (*3-k CONCENTRATION*) at 58.32% and 53.80%, respectively, compared to only 27.23% in the Philippines. Among the country-specific variables shown in Panel D, Vietnam has the highest average GDP growth rate (*BUSINESS CYCLE*) (7.39% per annum during 1998–2008) whereas Indonesia's is only 3.35%. The Index of Economic Freedom (*BANKING FREEDOM*) details that the five selected ASEAN countries are similar in terms of banking sector freedom, ranging from

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[8] The inclusion of the two variables, *RESTRICTIONS* and *ENTRY FREEDOM*, in the same equation is consistent with Mercieca et al. (2007).

[9] This is a composite index and takes on values between (1) and (4) for each of the four categories under consideration, whereby the activities are classified as unrestricted (1), permitted (2), restricted (3) or prohibited (4) with possible index variation between 4 and 16. These classifications are possible by utilizing the study conducted by Barth et al. (2004 and 2008). Higher values indicate greater restrictions on bank activities.

Table 5
Correlation matrix.

Variables		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	*RD*	1.00																
2	*FUND_LERNER*	0.11	1.00															
		0.00	*–*															
3	*D_SHARE*	0.04	0.13	1.00														
		0.08	*0.00*	*–*														
4	*L_SHARE*	0.02	0.19	**0.18**	1.00													
		0.09	*0.00*	**0.66**	*–*													
5	*BANKSIZE*	0.04	0.21	**0.27**	**0.09**	1.00												
		0.11	*0.00*	**0.64**	**0.65**	*–*												
6	*EFFICENCY*	−0.18	−0.01	0.03	0.02	0.09	1.00											
		0.00	*0.06*	*0.16*	*0.43*	*0.00*	*–*											
7	*NPL*	0.08	0.06	0.15	0.11	0.10	−0.04	1.00										
		0.00	*0.01*	*0.00*	*0.00*	*0.00*	*0.10*	*–*										
8	*NIM*	−0.08	−0.08	−0.24	−0.19	−0.22	−0.13	0.02	1.00									
		0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.31*	*–*									
9	*EQUITY*	0.19	0.08	−0.29	−0.27	−0.31	−0.21	−0.06	0.27	1.00								
		0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*	*–*								
10	*STATE*	0.04	0.04	0.19	0.16	0.17	0.08	0.07	−0.03	−0.09	1.00							
		0.14	*0.13*	*0.00*	*0.00*	*0.00*	*0.01*	*0.02*	*0.36*	*0.00*	*–*							
11	*ISLAMIC_PRODUCTS*	0.07	−0.11	0.17	0.14	0.20	−0.01	−0.07	−0.07	−0.11	0.08	1.00						
		0.02	*0.00*	*0.00*	*0.00*	*0.00*	*0.03*	*0.02*	*0.02*	*0.00*	*0.02*	*–*						
12	*LISTED*	0.06	0.12	0.26	0.29	0.36	0.28	0.08	−0.09	−0.19	0.18	−0.02	1.00					
		0.04	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.09*	*–*					
13	*DOMESTIC ≥ 50%*	−0.19	−0.09	0.06	0.07	−0.01	0.12	−0.01	−0.07	−0.17	0.18	−0.02	0.30	1.00				
		0.00	*0.00*	*0.04*	*0.01*	*0.05*	*0.00*	*0.05*	*0.02*	*0.00*	*0.00*	*0.41*	*0.00*	*–*				
14	*3k-CONCENTRATION*	0.16	0.14	0.10	0.11	0.08	0.11	−0.02	−0.13	−0.07	0.14	−0.13	0.10	0.14	1.00			
		0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.45*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*–*			
15	*BANKING FREEDOM*	0.03	0.27	0.22	0.21	0.30	0.13	0.20	−0.16	−0.06	−0.02	−0.10	0.26	−0.05	0.10	1.00		
		0.27	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.04*	*0.05*	*0.00*	*0.00*	*0.14*	*0.00*	*–*		
16	*RESTRICTIONS*	−0.06	−0.12	−0.32	−0.23	−0.29	−0.01	−0.13	0.31	0.06	0.07	−0.11	−0.08	0.15	0.01	−0.45	1.00	
		0.02	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.03*	*0.02*	*0.00*	*0.01*	*0.00*	*0.04*	*0.00*	*–*	
17	*BUSINESS CYCLE*	−0.06	−0.11	0.09	0.09	0.05	−0.10	−0.13	−0.06	0.02	0.07	0.01	−0.03	0.05	0.13	−0.09	0.01	1.00
		0.01	*0.00*	*0.00*	*0.00*	*0.03*	*0.00*	*0.00*	*0.01*	*0.37*	*0.01*	*0.32*	*0.27*	*0.07*	*0.00*	*0.00*	*0.03*	*–*

Source: Computed by authors using STATA software.
Note: This table presents Pearson product moment correlation (for dealing with paired continuous variable) and Kendall's tau-*b* is used for pairs with at least one binary variable. *p*-Values are provided in italic. The bold figures indicate that multicolinearity problems exist.

47.34 in Vietnam to 50 in Thailand.[10] Collectively, the above observations help justify the inclusion of bank-, industry- and country-specific control variables within the econometric models employed in this study. Specifically, they help to control for sample heterogeneity and thus increase the comparability of results across banking markets.

3.2. Correlation matrix

The correlation values are shown in Table 5. Although *D_SHARE* and *L_SHARE* manifest in high *p*-value (*p*-value > 0.5), significant multicollinearity is not a problem since these two variables will only be utilized alternatively in Eq. (1). In addition, *BANKSIZE* is highly correlated with *D_SHARE* and *L_SHARE*, suggesting that larger banks attract more deposits and loans. This indicates that when Eq. (1) is estimated with *D_SHARE* or *L_SHARE*, *BANKSIZE* must be excluded to avoid multicollinearity issues.

3.3. Association between bank market power and revenue diversification

All reported *t*-statistics are corrected for heteroskedasticity using White diagonal standard errors and covariance.[11] The standard errors are thus robust to heteroscedasticity. The results covering the entire sample period 1998–2008 are presented in Table 6, while Table 7 excludes the crisis years (i.e. 1998–1999 due to the AFC and 2007–2008 due to the GFC).[12]

The negative and significant coefficient for the quadratic variable *FUND_LERNER²* in Column 1 in Tables 6 and 7 (excluding crisis years) are opposite to the positive and significant coefficient for the *FUND_LERNER* variable. These results are also consistent across two alternative measures of bank market power (*L_SHARE* and *D_SHARE*) (from Columns 3 to 6 of Tables 6 and 7) and have the expected signs. These findings indicate a non-linear relationship between bank market power and revenue diversification. That is, at lower degree of market power in loan and deposit markets, bank managers appear to seek and exploit new growth opportunities in non-traditional markets leading to higher income from non-traditional activities. Those banks with greater market power in loan and deposit markets, however, seem to focus more on traditional interest-based products.

The coefficient signs and their statistical significance (from Columns 1 to 6 in Table 6) of *FUND_LERNER * Trend*, *L_SHARE * Trend* and *D_SHARE * Trend* provide mixed results. The first two variables have no impact on bank revenue diversification while the *D_SHARE*Trend* variable produces significant negative coefficients across all models. This suggests that credit losses experienced by banks, during and after the AFC may have encouraged ASEAN banks (especially those with market power in the deposit markets) to diversify into non-traditional activities to compensate for their excessive losses. When the market started to recover, however, these banks have refocused more on interest-based business. The results remain unchanged during the GFC across all models. The economic effect of the interaction term D SHARE*Trend is also significant, indicating that when bank market power increases by 1% over the sample period 1998–2008, non-interest income decreases by 0.013%.

3.4. Results for bank-, dummy, industry- and country-specific control variables

With regard to bank-specific control variables, the positive coefficient for *BANKSIZE* is statistically significant only when the crisis years are considered (Table 6). This suggests that during the crisis years, larger banks fare relatively well in earning non-interest revenue. This finding is consistent with DeYoung and Rice (2004), Mercieca et al. (2007) and Lepetit et al. (2008a). That is, smaller banks face difficulties gaining strong footholds in non-interest income earning activities. In contrast, larger banks arguably have more experience and expertise in using advanced technology to facilitate new services. We also obtain negative and significant coefficients for *EFFICIENCY* and *NIM* as expected. Banks seem to engage more in non-traditional activities if they experience higher credit losses (*NPL*) and have higher capital ratio (*EQUITY*). This suggests customers prefer less risky banks, thereby allowing them to generate revenue in non-traditional businesses (Lepetit et al., 2008b). Another possible explanation, provided by Merton and Bodie (1992) and Rogers and Sinkey (1999), is that banks need 'assurance capital' to enter into non-traditional activities.[13]

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[10] This index has a scale from 0 to 100, where a 100 represents the maximum freedom (Miles, Feulner, & O'Grady, 2010).

[11] A wide battery of diagnostics were conducted including Durbin–Wu–Hausman test for endogeneity, the Variance Inflation Factor and Tolerance Statistics for multicollinearity, the Breusch–Pagan/Cook–Weisberg tests for heteroskedasticity, the Jarque Bera tests for normality and the Hausman test for fixed versus random effect specifications. These results available from the authors indicate that there are no endogeneity issues or other violations of the regression assumptions and so fixed effects panel least squares is appropriate for estimating Eq. (1). Moreover, the fixed effect models help eliminate the omitted variable bias.

[12] Since Vietnam's financial heritage differs from the other sample countries, the entire analysis has also been redone without Vietnam. These results are consistent with our primary results and are available upon request. As another robustness test, the entire analysis was redone by replacing industry- and country-specific variables with country dummies in Eq. (1). While the association between bank market power and revenue diversification remains unchanged, we find that compared to Vietnamese banks, Indonesian, Malaysian and the Philippines commercial banks engage more in non-traditional activities, thereby generating more non-interest income. This is consistent with the observation that Vietnamese banks face more activity restrictions and enjoy less banking freedom. The preliminary analysis using the mean value of the data set discussed above confirms this result.

[13] According to Merton and Bodie (1992), such capital provides assurances against default risk to the customers who hold bank liabilities. This capital is beyond that required for funding of the physical investments and working capital needed to run the business. Banks with high level of assurance capital have a greater capacity to absorb asset losses from non-traditional activities. Financial markets and bank regulators may also require assurance capital for banks to enter new activities.

Table 6

Panel least squares estimates of the association between bank market power and revenue diversification for selected ASEAN banks during 1998–2008.

	Dependent variable: RD					
	FUND_LERNER		L_SHARE		D_SHARE	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
FUND_LERNER	0.0161*	1.9380	–	–	–	–
FUND_LERNER^2	−0.0077***	−3.6335	–	–	–	–
FUND_LERNER * Trend	−0.0001	−0.1684	–	–	–	–
L_SHARE	–	–	0.3766***	3.7689	–	–
L_SHARE^2	–	–	−1.8819***	−4.5968	–	–
L_SHARE * Trend	–	–	−0.0054	−0.7256	–	–
D_SHARE	–	–	–	–	0.2120***	3.9446
D_SHARE^2	–	–	–	–	−0.2402***	−3.6369
D_SHARE * Trend	–	–	–	–	−0.0136****	−2.7056
BANKSIZE	0.0010**	2.1535	–	–	–	–
EFFICIENCY	−0.0000**	−1.9958	−0.0000*	−1.4229	−0.0000*	−1.7385
NPL	0.0002***	3.9670	0.0002***	3.3065	0.0002**	3.5347
NIM	−0.0004**	−2.2810	−0.0004**	−2.2126	−0.0004**	−2.1887
EQUITY	0.0005***	4.4861	0.0006***	7.1678	0.0006***	6.2405
STATE	0.0000	0.3048	0.0000***	2.0617	0.0000**	2.3053
DOMESTIC ≤ 50%	−0.0030**	−1.9984	−0.0037**	−2.5638	−0.0038***	−2.6767
ISLAMIC_PRODUCTS	0.0088***	3.3967	0.0050**	2.1327	0.0051*	2.0518
LISTED	0.0006***	0.4962	0.0026*	1.9538	0.0023**	1.6977
3k-CONCENTRATION	0.0091**	1.9860	0.0105**	2.3024	0.0102**	2.1070
ENTRY FREEDOM	0.0000	0.4838	0.0000	0.1807	0.0000	0.6369
RESTRICTIONS	−0.0001**	−0.4090	−0.0007***	−2.6185	−0.0007**	−2.3044
BUSINESS CYCLE	−0.0003	−0.6541	−0.0007	−1.4113	−0.0008*	−1.7059
CONSTANT	0.0189	2.0477	0.0037	0.5266	0.0044	0.5978
Adjusted R-squared	0.1946		0.2309		0.2218	
F-statistic	9.4284		11.0413		11.1067	
Cross-sections included	146		146		146	
Total panel (unbalanced) observations	835		837		831	

Source: Respective central bank websites, *BankScope*, World Bank (2011)'s World Development Indicators (WDI), Barth et al. (2004, 2006, 2008), s *International Financial Statistics* (IFS) and the Heritage Foundation and *the Wall Street Journal* (Miles et al., 2011).

Note: This table presents panel least squares estimates (with correction for fixed period effects) for selected ASEAN banks during 1998–2008. The reported *t*-statistics are corrected for heteroskedasticity using White diagonal standard errors and covariance in EViews software.

* Significance at 10% level.

** Significance at 5% level.

*** Significance at 1% level.

In reference to dummy variables, state-owned banks (*STATE*) have greater capacity to generate more non-interest income than private-owned ones, manifested by the coefficients that are positive and significant from Columns 3 to 6 in Tables 6 and 7. The domestic ownership variable (*DOMESTIC ≥ 50%*) has a significant and inverse relationship with revenue diversification, suggesting that foreign banks have a relatively higher share of income from non-traditional activities. This is consistent with Berger et al. (2000) "global advantage" view that foreign institutions with superior managerial skills and best practice polices can overcome any cross-border disadvantages and operate abroad more efficiently than domestic institutions. In addition, foreign banks may have easier access to advanced technology and so are able to introduce product innovation in consumer banking, fee generation and international services more easily than their domestic competitors. Moreover, as expected listed banks (*LISTED*) and those with Islamic banking subsidiaries (*ISLAMIC_PRODUCTS*) are found to earn more non-interest income.

The market concentration ratio (*3k-CONCENTRATION*) has a positive relationship with revenue diversification. It appears that increased concentration due to mergers and acquisitions following the AFC may reduce competition, and so, increase bank market power and thereby their non-interest income.[14] The country-specific variables show that banks' ability to diversify their revenue depends on various industry restrictions. The negative coefficients for *RESTRICTIONS* support this view. In relation to overall economic conditions, the unexpected negative and significant coefficients of *BUSINESS CYCLE* (in Columns 5 and 6 of Tables 6 and 7) suggest that during an economic boom, bank interest income grow faster than fee and commission income. In contrast, non-traditional banking products become more important with the lower demand for loans during slow economic growth.[15]

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[14] The specific details of these mergers and acquisitions can be found in Cook (2008).

[15] Our findings were subjected to several robustness tests: (1) a Granger Causality test as an alternative test for endogeneity, (2) a different proxy of the market structure: five-bank asset concentration (*5k-CONCENTRATION*), and (3) DOMESTIC ≥ 70% as an alternative classification of foreign- versus domestic-owned banks. Their results are summarized in Appendix A.

Table 7
Panel least squares estimates of the association between bank market power and revenue diversification for selected ASEAN banks during 2000–2006.

	Dependent variable: RD					
	FUND_LERNER		L_SHARE		D_SHARE	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
FUND_LERNER	0.0334**	2.372	–	–	–	–
FUND_LERNER^2	−0.0073***	−2.703	–	–	–	–
FUND_LERNER*Trend	−0.0022	−1.175	–	–	–	–
L_SHARE	–	–	0.3504***	3.395	–	–
L_SHARE^2	–	–	−1.6709***	−3.821	–	–
L_SHARE*Trend	–	–	−0.0081	−0.895	–	–
D_SHARE	–	–	–	–	0.1776***	2.785
D_SHARE^2	–	–	–	–	−0.1893***	−3.041
D_SHARE*Trend	–	–	–	–	−0.0127*	−1.840
BANKSIZE	0.0006*	1.132	–	–	–	–
EFFICIENCY	−0.0000**	−0.722	−0.0000**	−0.147	−0.0000*	−0.550
NPL	0.0002***	4.510	0.0002***	3.995	0.0002***	3.832
NIM	−0.0004***	−1.322	−0.0005**	−1.486	−0.0004**	−1.218
EQUITY	0.0006***	3.912	0.0007***	6.254	0.0007***	4.975
STATE	0.0000	0.353	0.0000*	1.565	0.0000*	1.835
DOMESTIC ≤ 50%	−0.0038**	−2.069	−0.0041**	−2.615	−0.0045**	−2.584
ISLAMIC_PRODUCTS	0.0102***	3.375	0.0069**	2.490	0.0070*	2.423
LISTED	0.0016**	0.947	−0.0012**	0.640	0.0001**	0.093
3k-CONCENTRATION	0.0044**	0.699	−0.0038*	0.556	0.0028*	0.423
ENTRY FREEDOM	0.0000	0.617	−0.0000	0.192	0.0000	0.138
RESTRICTIONS	−0.0000**	−0.153	−0.0006*	−1.936	−0.0005*	−1.510
BUSINESS CYCLE	−0.0000	−0.079	−0.0007*	−1.046	−0.0006*	−0.914
CONSTANT	0.016	1.347	0.0028	0.255	0.0039	0.422
Adjusted R-squared	0.2204		0.2401		0.2090	
F-statistic	8.0920		9.3370		7.9221	
Cross-sections included	130		130		129	
Total panel (unbalanced) observations	553		555		551	

Source: Respective central bank websites, BankScope, World Bank (2011)'s World Development Indicators (WDI), Barth et al. (2004, 2006, 2008), s International Financial Statistics (IFS) and the Heritage Foundation and the Wall Street Journal (Miles et al., 2011).
Note: This table presents panel least squares estimates (with correction for fixed period effects) for selected ASEAN banks during 2000–2006. The reported t-statistics are corrected for heteroskedasticity using White diagonal standard errors and covariance in EViews software.
* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

4. Conclusion

This paper investigated the association between bank market power and revenue diversification using a sample of 153 commercial banks from five selected ASEAN member countries (Indonesia, Malaysia, the Philippines, Thailand and Vietnam) during 1998–2008 and 2000–2006 (excluding crisis years). Following Turk-Ariss (2010), we employed bank-level measures of competition and found a non-linear association between bank market power and revenue diversification. At lesser degrees of market power in loan and deposit markets, bank managers focused more on new growth opportunities in non-traditional markets, leading to a higher non-interest income. Those banks with greater degrees of bank market power, however, concentrated more on traditional interest-based products. We also found that the association between bank market power and revenue diversification had changed over time, suggesting that credit losses experienced by banks earlier, during and after the AFC encouraged ASEAN banks (especially those with market power in the deposit markets) to diversify into non-traditional activities to compensate for their losses. When the markets recovered and loan demand increased, however, traditional interest-based business has become more important. After excluding the crisis years (1998 and 1999 due to the AFC and 2007 and 2008 due to the GFC), our results remained consistent across all models.

Our findings provide important implications for bank managers, investors, regulators and policy makers. For bankers, the results show that domestic ASEAN banks lag behind their foreign counterparts in earning non-interest revenue and highlight the importance of investing in the necessary expertise to facilitate their non-traditional activities. Those ASEAN banks should also lobby the regulators to relax activity restrictions so they can diversify their revenue sources. For investors, since traditional interest-based and non-interest income generating products have different risk implications, it is important to select banks with better revenue diversification strategies. For the regulators and policy makers, the findings emphasize the benefit of relaxing activity restrictions allowing ASEAN banks to diversify their product offerings. They should, however, closely scrutinize these banks (especially dominant ones) moving into non-traditional activities since these revenue sources can be associated with increased overall bank risk.

This study, however, suffers from three main limitations. First, our cross-sectional sample size is limited due to the large number of foreign branches and subsidiaries who do not produce separate financial statements (hence not in *BankScope*). Any technological determinants of non-interest income such as numbers of ATMs are also omitted because of data unavailability. Third, throughout the study, annual bank-specific data were used due to lack of more frequent data (for example, weekly or monthly data).

With regard to possible extensions to this research, we suggest two avenues. First, future research might investigate in the association between bank market power and revenue diversification within a given national market due to intra-country differences across states, provinces, districts and so on. Second, the annual financial data may not accurately represent changes in a bank financial performance within a given year. Thus, this study could be broadened and strengthened by employing monthly or quarterly data.

Appendix A. Robustness tests

A.1. Alternative test for endogeneity – the Granger Causality test

As rationalized by Hill, Griffiths, and Lim (2007), if the instruments used in the Durbin–Wu–Hausman test are weak, the estimator can suffer large biases and standard errors. Thus, a Granger Causality test is employed as an alternative test for endogeneity. Its assumption is that the two series to be tested are stationary. Therefore, a unit root test was used to verify this key assumption and the result finds that the series are stationary. The Granger Causality test available from the authors shows that the p-value is not significant indicating that there is no causality problem. Thus, the Granger Causality test confirms the Durbin–Wu–Hausman endogeneity test.

A.2. 5k-CONCENTRATION ratio in place of 3k-CONCENTRATION ratio

One drawback of the *3k-CONCENTRATION* ratio is that there is no rule for the determination of the value of *k*. Assigning the value of 3 to *k* is a somewhat arbitrary decision (Bikker & Haaf, 2002; Claessens & Laeven, 2004), a *5k-CONCENTRATION* ratio is then used in Eq. (1). The results available from the authors confirm that banks with higher market power earn higher income from non-traditional activities and that association is non-linear and has changed over time.

A.3. DOMESTIC ≤ 70% in place of DOMESTIC ≤ 50%

While a less than 50% domestic ownership removes foreign bank subsidiaries, foreign bank influence may still be important at lower foreign ownership level. As a result, we also classified banks that are 30% or more foreign-owned (*DOMESTIC ≤ 70%*) as foreign-owned (Grigorian & Manole, 2002). Under this definition, the number of foreign-owned banks in the sample increases by 5%. The results are broadly consistent with those with the primary *DOMESTIC ≤ 50%*.

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