Bank Competition and Financial Stability in Asia Pacific

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Abstract

Bank competition is at the center of the academic and policy debate regarding financial stability. The recent financial crisis further demonstrates the urgent need to address the trade-offs between bank competition and financial soundness. Using data on 14 Asia Pacific economies from 2003 to 2009, this study investigates the influence of bank competition, concentration, regulation and national institutions on individual bank fragility as measured by the probability of bankruptcy and the bank's Z-score. The results suggest that greater concentration fosters financial fragility and that lower pricing power also induces bank risk exposure when macroeconomic, bank-specific, regulatory and institutional factors are controlled for. In addition, there is no evidence that shows that larger banks in this region could better diversity their portfolios. Finally, the results indicate that better institutional development and stringent capital requirements improve financial stability, whereas property rights and deposit insurance are associated with greater bank fragility.

JEL classification: G21, G28

Keywords: Bank competition; Financial stability; Banking regulation, Banks in Asia Pacific

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1. Introduction

The impact of bank competition on financial stability has been a key focus of the academic and policy debates during the past two decades. Under the traditional competition-fragility view, more competitive and/or less concentrated banking systems are more fragile. Under the alternative competition-stability view, more competitive and/or less concentrated banking systems are more stable. Berger et al. (2009) develop a neutral view that argues that competition and concentration can coexist and can simultaneously induce financial stability or fragility. Meanwhile, the financial crisis has further demonstrated the urgent need to address the complex relationship between bank competition and financial soundness (OECD, 2011). In particular, recent studies of the causes of the credit crunch have highlighted deregulation and excessive competition as factors that led to financial sector meltdowns in the US and the UK (Llewellyn, 2007; Brunnermeier, 2009; Milne, 2009). Unlike its US and European counterparts, however, the Asia Pacific banking industry emerged from the global turmoil in a comparatively strong position without requiring anywhere near the same degree of government support and bailouts. Therefore, this region offers a particularly interesting environment in which to study the competition-stability nexus in banking. Although a vast body of literature has emerged that addresses this critical issue,[4] to our knowledge, the problem has inadequately addressed for banks across the Asia Pacific region.[5]

Against this backdrop, this study investigates the impact of bank competition on financial stability for 14 Asia Pacific economies over the period from 2003 to 2009. This study complements and extends previous studies[6] on this issue in several specific respects. First, whereas previous studies have focused on either real banking crises or Z-scores in measuring bank risk, this study extends the analysis by employing the probability of bankruptcy as an indicator of individual bank fragility.[7] A real banking crisis can be an accurate indicator, but its significance may be distorted for the following reasons: (1) banking crises are defined and announced differently across countries; (2) regulators are less interested in announcing banking failures because they may imply regulatory failures; and (3) regulators are reluctant to announce the failures of banks that play a key role within the system because they wish to avoid contagion effects (Uhde and Heimeshoff, 2009). The probability of bankruptcy, computed using the Black and Scholes (1973) and Merton (1974) contingent claims

[4] Beck (2008) provides an excellent survey of the literature on bank competition and financial stability.
[5] Soedarmon et al. (2011) and Liu et al. (2012) estimate the competition-stability nexus for banks in 12 Asian economies and four South East Asian countries, respectively. In addition, a small number of cross-country empirical studies include several Asia Pacific economies into their large sample sets in testing this relationship. See, for example, De Nicol'o (2003), Beck et al. (2006a), Boyd et al. (2006), Evrensel (2008), Berger et al. (2009), Schaeck et al. (2009), Behr et al. (2010), Turk Ariss (2010), and Anginer et al. (2012).
[6] See, for example, De Nicol´o et al. (2003), Beck et al. (2006a), Boyd et al. (2006), Yeyati and Micco (2007), Berger et al. (2009), Schaech and Cihak (2008), Schaeck et al. (2009), Uhde and Heimeshoff (2009), Behr et al. (2010), Turk-Ariss (2010), Agoraki et al. (2011), Soedarmon et al. (2011), and Liu et al. (2012).
[7] The Z-score is also used in this study to determine the robustness of our results.

approaches, provides a more appealing alternative. Compared to the use of accounting-ratio-based models (e.g., Z-score), this market-based methodological approach has the following advantages: (1) in efficient markets, stock prices reflect all of the information contained in accounting statements and contain information that is not in the accounting statements; (2) market variables are unlikely to be influenced by firm accounting policies; and (3) market prices reflect future expected cash flows and thus should be more appropriate for use for prediction purposes.

Second, according to the structure-conduct-performance proposition, competition and concentration are inversely related; a more concentrated market will feature a lower degree of competition. However, the theory of contestability (Baumol, 1982; Baumol et al., 1982) maintains that under particular conditions, competition and concentration can coexist. Thus, this study includes both structural and non-structural measures of competition in its models to address the nexus of concentration, competition and stability in Asia Pacific banking for the first time.[8] Third, to our knowledge, this is the first study that incorporates both regulatory and institutional environmental factors into its models in testing the competition-stability relationship for banks in the Asia Pacific region. Fourth, this study considers a recent, large sample of 14 Asia Pacific economies for the period between 2003 and 2009. Moreover, the period examined encompasses the recent global financial crisis. Thus, the results of the study may highlight the impact of the global turmoil on individual bank risk exposure in this region. Finally, this study includes a series of sensitivity analyses conducted by implementing alternative estimation procedures (Tobit vs. logistic regressions) and using various specifications.

The results suggest that greater concentration fosters financial fragility, whereas lower pricing power also induces bank risk exposure in Asia Pacific when macroeconomic, bank-specific, regulatory and institutional factors. This finding supports the neutral view of the competition-stability relationship. It also implies that some banks in this region are able to attain greater discretion in price-setting to boost their profits and reduce their insolvency risk through channels other than increased concentration, such as product differentiation. Furthermore, there is evidence that larger banks are more likely to fail than their smaller counterparts in this region, possibly because monitoring a large bank is more difficult than monitoring a small bank. Finally, the results indicate that better institutional development and stringent capital requirements improve financial stability, whereas property rights and deposit insurance are associated with greater bank fragility.

[8] The structural approach focuses on market structure measures such as market shares, concentration ratios for the largest sets of firms, and a Hirschman-Herfindahl index. Structural indicators measure actual market shares but do not allow inferences regarding the competitive behavior of banks. Non-structural measures are used to quantify bank pricing behavior. They include the Lerner index and the H-statistic (Berger et al., 2004).

The remainder of the paper is organized as follows. Section 2 provides a review of the literature on competition and stability in banking. Section 3 introduces the econometric methodology. Section 4 describes the data used in the econometric tests. Section 5 presents the empirical results, and Section 6 discusses several conclusions.

2. Literature review

Economic theory provides ambiguous predictions regarding the relationship between bank concentration, competition and stability. Most theoretical models do not make a distinction between structural and non-structural indicators of competition. Following common practice, this study summarizes the literature using the "one-to-one mapping" approach, i.e., "assuming a one-to-one mapping from market structure to competitive behavior of banks" (Beck, 2008).

Under the traditional competition-fragility hypothesis, more competitive and/or less concentrated banking systems are more fragile. The "charter/franchise value" of banking, as modeled by Marcus (1984), Chan et al. (1986), and Keeley (1990), suggests that competition drives banks to undertake risk-taking strategies due to the contraction of the latter's franchise value. These models show that a higher charter or franchise value arising from increased market power may deter excessive risk-taking behavior by the bank's management. Because higher franchise value results in higher opportunity costs during bankruptcy, bank managers and bank shareholders may become more reluctant to engage in risky activities, which may improve bank asset quality.

Diamond (1984), Ramakrishnan and Thakor (1984), Boyd and Prescott (1986), Williamson (1986), and others show that more concentrated banking systems are composed of larger banks and that larger banks can capitalize on economies of scale and scope and better diversify their portfolios. Smith (1984) argues that banking relationships may endure for longer periods in less competitive environments if the information on the probability distribution of depositors' liquidity needs is private. Hence, greater concentration and less competition could reduce liability risk and lead to greater stability in banking. Boot and Greenbaum (1993) and Allen and Gale (2000, 2004) suggest that in a more competitive environment, banks earn less informational rent from their relationships with borrowers, which reduces their incentives to properly screen borrowers and increases the risk of fragility.

Competition can impact stability through contagion. Using a model of financial contagion in the interbank market, Allen and Gale (2000) suggest that under perfect competition, all banks are price takers and none has an incentive to provide liquidity to troubled banks. As a result, troubled banks eventually fail, with negative repercussions for the entire sector. Similarly, Saez and Shi (2004) argue

that banks can cooperate, act strategically and help other banks to cope with temporary liquidity shortages in a market characterized by imperfect competition. Allen and Gale (2000) also find that a concentrated banking system with a small number of large institutions is more stable because the banks are easier to monitor, less burdened by supervision, and therefore more resilient to shocks. Boot and Thakor (2000) suggest that larger banks tend to engage in "credit reputation/rating" because making fewer high-quality credit investments can increase the return of individual investments and thereby encourage financial soundness. Additionally, larger banks are assumed to enjoy comparative advantages related to the provision of credit monitoring services.

Allen and Gale (2004) claim that financial crises are more likely to occur in less concentrated banking systems due to the absence of powerful providers of financial products that could reap benefits from the high profits that thus serve as a buffer against asset quality deterioration. Similarly, Boyd et al. (2004) state that the presence larger (monopolistic) banks in concentrated banking systems might enhance profits and thus reduce financial fragility by providing higher "capital buffers" that protect these systems against external macroeconomic and liquidity shocks.

A different argument among proponents of the competition-fragility hypothesis is that deposit insurance schemes can reduce fragility by preventing bank runs but also introduce moral hazard by providing incentives to banks to engage in riskier activities. Thus, in more competitive environments, more generous deposit insurance may undermine bank stability (Diamond and Dybvig, 1983; Matutes and Vives, 1996). In addition, Hellmann, et al. (2000) suggest that deposit interest rate ceilings are still necessary to prevent banks from taking excessive risk in competitive markets, although minimum capital requirements can boost the charter value.

Under the alternative competition-stability hypothesis, more competitive and/or less concentrated banking systems are more stable. The "too big to fail" doctrine (Mishkin, 1999) indicates that policymakers are more concerned about bank failures when the number of banks in a concentrated banking system is low. Thus, these large banks are often more likely to receive public guarantees or subsidies, which may generate a moral hazard problem, encourage risk-taking behavior and intensify financial fragility. Moreover, contagion risk may increase in a concentrated banking system with larger banks.

Caminal and Matutes (2002) claim that less competition can result in less credit rationing and larger loans, ultimately increasing the probability of bank failure. Boyd and De Nicolo (2005) argue that concentrated banking systems allow banks to charge higher loan rates, which may encourage borrowers to assume greater risk. Consequently, the volume of nonperforming loans may increase,

resulting in a higher probability of bank failure. However, Martinez-Miera (2008) suggests that higher loan rates also produce higher interest revenues for banks. This dynamic might generate a U-shaped relationship between bank competition and stability.

Beck et al. (2006a, b) suggest that bank size is positively correlated with organizational complexity; for example, monitoring a large bank is more difficult than monitoring a small bank. Accordingly, as firm size increases, transparency may decrease as a result of expansion across multiple geographic markets and business lines and the use of sophisticated financial instruments that facilitate the establishment of complex corporate organizations. These developments may reduce managerial efficiency and internal corporate control and may increase operational risk. Increasing organizational complexity can render both market discipline and regulatory action less effective in preventing excessive risk exposure (Cetorelli et al., 2007).

However, as indicated in Berger et al. (2009), the two strands of the literature do not inherently produce opposing predictions regarding the relationship between bank competition and financial stability. The researchers argue that the overall risks of banks may not increase even if market power encourages riskier asset portfolios because banks may protect their charter values by using other methods to offset the greater risk exposure. Such methods may include increasing equity capital, reducing interest rate risk, and selling credit derivatives.

The aforementioned theoretical studies have been supplemented by empirical findings. As indicated in Berger et al. (2004) and Beck (2008), bank concentration is not an appropriate measure of bank competition, and bank concentration influences financial stability through channels other than bank competition. Thus, this study focuses on reviewing the cross-country studies that simultaneously estimate the relationship between concentration, competition, and banking stability.

Using a database for commercial banks in eight Latin American countries for the period from 1993-2002, Yeyati and Micco (2007) find a positive relationship between bank risk (as measured by the Z-score) and competition (as captured by the H-statistic), whereas the coefficient for bank concentration is not significant. This result lends support to the competition-fragility paradigm. Schaeck and Cihak (2008) analyze the relationship between bank competition and soundness using a sample of more than 3,600 banks from ten European countries and more than 8,900 U.S. banks for the period from 1995 to 2005. They suggest that competition as measured by the Boone indicator increases bank soundness by increasing efficiency and that more concentrated banking markets benefit financial stability. Using data from 31 systemic banking crises in 45 countries

for the period from 1980 to 2005, Schaeck et al. (2009) show that competition (as captured by H-statistics) reduces the likelihood of a crisis and increases the time to crisis, even after they control for banking system concentration, which is positively related to financial fragility.

Using data for 8,235 banks in 23 industrial countries for the years 1999-2005, Berger et al. (2009) conclude that banks with a greater degree of market power according to the Lerner index have less overall risk exposure, as captured by their Z-scores. These findings support the traditional competition-fragility view. On the other hand, the data also show that banking market power results in riskier loan portfolios, as indicated by the non-performing loan ratios. The researchers argue that banks can protect their charter value from higher loan risk by holding more equity capital. Employing a sample of 1,872 publicly traded banks in 63 countries for the period between 1997 and 2009, Anginer et al. (2012) examine the relationship between competition according to the Lerner index and systemic stability as captured by default risk under Merton's (1974) contingent claim pricing framework. The results suggest a positive relationship between competition and systemic stability. The researchers conduct a robustness check by using bank asset concentration as an alternative proxy for bank competition. The results remain the same.

Liu et al. (2012) introduce the ratio of loan-loss provisions to total loans, the ratio of loan-loss reserves to total loans, the volatility of bank after-tax ROA and the natural logarithm of the Z-index as measures of bank risk in investigating the effects of competition on banks' risk-taking behavior from 1998 to 2008 in four South East Asian countries: Indonesia, Malaysia, the Philippines and Vietnam. The empirical results indicate that competition as captured by the H-statistic is inversely and significantly related to most risk indicators except the natural logarithm of the Z-index, which suggests that competition does not erode bank stability. The researchers also find that concentration is negatively associated with bank risk, whereas regulatory restrictions positively influence bank fragility. Overall, the cross-country evidence yields mixed results regarding the relationship between bank concentration, competition, and stability. Meanwhile, the findings confirm that bank concentration and competition can coexist and affect financial stability through different channels.

3. Methodology

To test whether bank concentration and competition affect bank stability using bank-level data from 14 Asia Pacific economies, the following baseline model is used:

$$Bank\ Risk = f\ (Concentration, Competition, Bank\ Controls, Macro\ Controls) \quad (1)$$

Beck et al. (2006a) suggest that there are two reasons why cross-country differences in bank regulatory policies and national institutions should also be considered when researchers assess the relationship between bank competition and financial stability. First, this approach provides a simple robustness test for the competition-stability relationship. Second, this approach presents additional information about the links between bank regulations, national institutions, and financial stability. Assuming that countries implement regulations to promote banking system stability, examining this relationship is independently valuable. On the other hand, the development of the institutional environment is a key factor in the development of financial systems. Hence, this study also controls for different bank regulations and institutional environments in further investigating the effect of concentration and competition on bank stability. The model has the following general form.

Bank Risk = f (Concentration, Competition, Bank Controls, Macro Controls, Regulatory Controls, Institutional Controls) (2)

Market-based risk measure

Black and Scholes's (1973) and Merton's (1974) Distance to Default model is used to estimate the insolvency risk of listed banks. The model has been widely used in empirical research.[9] The Distance to Default model views equity as a call option on the assets of a firm, with a strike price equal to the face value of the liabilities at time T when the liabilities mature. At time T, equity holders exercise their option and pay off the debt holders if the value of the firm's assets is greater than the face value of its liabilities. Otherwise, if the value of the assets is insufficient to fully repay the firm's debts, the call option becomes worthless, and equity holders let it expire. In this scenario, the firm files for bankruptcy, and ownership is assumed to be transferred to the debt holders at no cost, whereas the payoff for equity holders is zero. Estimates for the probability of bankruptcy are given by McDonald (2002). They are modified for dividends, and they reflect the fact that the stream of dividends paid by the firm accrues to the equity holders:

$$P = \mathrm{N}\left(-\frac{\ln\left(\frac{V_A}{\mathrm{D}}\right) + \left(\mathrm{u} - \delta - \left(\frac{\sigma_A^2}{2}\right)\right)\mathrm{T}}{\sigma_A\sqrt{\mathrm{T}}}\right) \quad (3)$$

where
P = the probability of bankruptcy
N( )= the cumulative normal density function
V_A = the value of assets
D = the face value of debts proxied by total liabilities

[9] For example, see Hillegeist et al. (2004), Vassalou and Xing (2004), Gropp et al. (2004, 2006), Akhigbe et al. (2007), Chan-Lau and Sy (2007), Duffie et al. (2007), Bharath and Shumway (2008), and Campbell et al. (2008).

u = the expected return
δ = the dividend rate estimated as total dividends/ (total liabilities + market value of equity)

σ_A = the standard deviation of assets (asset volatility)
T = the time to expiration (taken to be 1-year)

V_A, *u* and σ_A are not observable. This study uses the following method outlined by Bharath and Shumway (2008):

$$V_A = V_E + \mathrm{D} \tag{4}$$

$$\sigma_A = \frac{V_E}{V_A}\sigma_E + \frac{\mathrm{D}}{V_A}\sigma_D \tag{5}$$

$$\sigma_D = 0.05 + 0.25 * \sigma_E \tag{6}$$

$$\mathrm{u} = r_{i,t-1} \tag{7}$$

where
V_E = the market value of common equity
V_A = the total value of assets
D = the face value of debts proxied by total liabilities

σ_A = the standard deviation of assets (asset volatility)

σ_E = the standard deviation of daily stock returns multiplied by the square root of the average number of trading days in the year (set at 252 trading days)
u = the expected return

$r_{i,t-1}$ = the bank's stock returns over the previous year[10]

Accounting-based risk measure

Based on accounting data, the Z-score is computed to measure the insolvency risk of listed and non-listed banks. It is an inverse proxy of a firm's probability of failure, and it combines profitability, leverage, and return volatility in a single measure. For each bank *i* and time *t*, Z_{it} is defined as follows:

$$\mathrm{Z}_{it} = \frac{\mathrm{ROA}_{it}+\mathrm{E}_{it}/\mathrm{TA}_{it}}{\sigma_{\mathrm{ROA}_{it}}} \tag{8}$$

where
ROA = the return on assets
E/TA = the equity to total assets ratio

σ_{ROA} = the standard deviation of return on assets

Concentration and competition measures

[10] Because expected returns should not be lower than the risk-free rate, the expected return is set equal to the risk-free rate when expected returns are lower than the risk-free rate.

First, based on the structural approach, the degree of market concentration is used. Market concentration is measured as the ratio of the assets of the three largest banks to the assets of the total banking system in the country in question (CR3). Second, a non-structural indicator, the Lerner index (LERNER), is used to measure the degree of competition. This indicator has been widely used in recent bank research.[11] The Lerner index captures the capacity of price power by calculating the difference between price and marginal cost as a percentage of price.[12] The degree of competition is given by the range 0 < Lerner index < 1. In the case of perfect competition, the Lerner index = 0; under a pure monopoly, the Lerner index = 1. A Lerner index < 0 implies pricing below the marginal cost and could result, for example, from non-optimal bank behavior. Algebraically, the Lerner index is calculated as follows:

$$\text{Lerner}_{it} = (P_{TA_{it}} - MC_{TA_{it}})/P_{TA_{it}} \quad (9)$$

where

$P_{TA_{it}}$= the price of total assets proxied by the ratio of total revenues (interest and non-interest income) to total assets for bank *i* at time *t*

$MC_{TA_{it}}$ = the marginal cost of total assets for bank *i* at time *t*.

Following Fernández de Guevara et al. (2005), we can calculate the output price ($P_{TA_{it}}$) as the ratio of total revenues (interest and non-interest income) to total assets. Limited statistical data are available for use in estimating separate prices for loans and deposits. Loan revenue data do not separate earned income from fixed income investments, and the financial costs of deposits are included with those of other liability products. Hence, a single indicator of banking activity is used in this empirical approach. As suggested by Shaffer (1993) and Berg and Kim (1994), the total assets of each bank are used to measure banking output. In addition, under the assumption that the heterogeneous flow of goods and services supplied by a bank is proportional to its total assets, the output price includes both interest income and non-interest income. The latter has become increasingly important to the income structures of banks in recent years.

To derive $MC_{TA_{it}}$, the following translog cost function is estimated separately for each country to reflect the use of different technologies while capturing bank specificities using bank fixed effects:

[11] For example, see Claessens and Laeven (2004), Maudos and Fernández de Guevara (2004), Fernández de Guevara et al. (2005), Berger et al. (2009), and Maudos and Solís (2009).

[12] The H-statistic, developed by Panzar and Rosse (1987), is an alternative tool for inferring the degree of competition in the banking industry. It is computed from reduced form revenue equations, and it measures the sum of the elasticities of a bank's revenue with respect to the bank's input prices (Claessens and Laeven, 2004). A critical feature of the H-statistic is that the test must be undertaken in long-run equilibrium.

$$\ln TC_{it} = \alpha_0 + \sum_{j=1}^{2} \alpha_1 \ln w_{it}^{j} + \frac{1}{2}\sum_{j=1}^{2}\sum_{k=1}^{2} \alpha_{jk} \ln w_{it}^{j} \ln w_{it}^{k} + \beta_1 \ln TA_{it} + \frac{1}{2}\beta_2 (\ln TA_{it})^2$$

$$+ \sum_{j=1}^{2} \beta_{2j} \ln TA_{it} \ln w_{it}^{j} + \gamma_{1t} T + \frac{1}{2}\gamma_{2t} T^2 + \sum_{j=1}^{2} \gamma_{3t} T \ln w_{it}^{j} + \gamma_{4t} T \ln TA_{it} + \varepsilon_i \quad (10)$$

$$MC_{TA_{it}} = \frac{\partial TC_{it}}{\partial TA_{it}} = (\beta_1 + \beta_2 \ln TA_{it} + \sum_{j=1}^{2} \beta_{2j} \ln w_{it}^{j} + \gamma_{4t} T) \frac{TC_{it}}{TA_{it}} \quad (11)$$

where
TC_i = the bank's total costs
TA_i = the total assets
w_i = the price of the factors of production, defined as follows:
w_1 = the price of purchased funds: interest expenses/total deposits and short-term funding
w_2 = the price of labor and physical capital: non-interest expenses/fixed assets[13],
T = the time trend that captures the influence of technological changes that lead to shifts in the cost function over time
ε = the error term

As usual,[14] symmetry restrictions apply to this function (i.e.$\alpha_{jk} = \alpha_{kj}$). Meanwhile, the total cost and input price terms are normalized by w_2. This imposes linear homogeneity to ensure that the cost minimizing bundle does not change if all of the input prices are multiplied by the same positive scalar. Thus, only changes in the ratios of the input prices affect the allocation of inputs.

Bank-specific control variables

A bank's asset size (SIZE) is defined as the logarithm of its total assets. The ratio of loan loss provisions to total assets (LLP) is used to measure output quality and the way in which managers invest in high risk assets. The net interest margin (NIM) is employed to track the profitability of a bank's investing and lending activities.

Macroeconomic variables

The rate of real GDP growth (RGDP) is used as a proxy of the fluctuations in economic activity.

[13] Because of the lack of labor data, non-interest expenses are used as a proxy for labor and physical capital costs.
[14] See Claessens and Laeven (2004), Maudos and Fernández de Guevara (2004), Fernández de Guevara et al. (2005), Berger et al. (2009), and Maudos and Solís (2009).

To investigate the influence of the recent financial crisis on banks' overall risk exposure, a crisis dummy is considered. The crisis dummy takes a value of one for the years 2008 and 2009 and a value of zero for the years 2003-2007.

Regulatory variables

The variable *entry restriction* is the ratio of the number of entry applications denied to the number of applications received from domestic and foreign entities. The effect of this control variable on bank stability is expected to be ambiguous because restricted entry may reduce competitive pressure and thereby increase domestic bank profits, but it may also induce market inefficiencies.

Activity restriction is a key determinant of the scope of a bank's ability to provide fee-paying services. This measure reflects whether securities market activities (e.g., underwriting, brokering, dealing, and all activities within the mutual fund industry), insurance activities (e.g., insurance underwriting and sales), real estate activities (e.g., real estate investment, development, and management), and the ownership of non-financial firms are unrestricted, permitted, restricted or prohibited for the bank. The aggregate indicator therefore ranges from zero to twelve,[15] with higher numbers indicating more restrictions on bank activities and nonfinancial ownership and control. Restrictions on permissible banking services might improve the safety and soundness of the banking system by preventing banks from entering excessively risky lines of business, eliminating some conflicts of interest, and simplifying supervision. Such restrictions, however, might also reduce or eliminate opportunities for banks to diversify their asset risk outside traditional lines of business, realize economies of scale or scope, or manage earning variability across product lines.

Capital requirement indicates the minimum capital requirement (capital-to-assets ratio) per country, which is interpreted as a measure of entry barriers. In addition, greater equity capital encourages prudent behavior. Hence, greater capital requirements are expected to indicate a more stable banking market.

Financial freedom is an indicator of the openness of a financial system. This measure indicates the degree of government interference in the financial sector, considering regulation, financial products, and the allocation of credit; the freedom of foreign banks to operate; and the degree of regulation of financial market activities. Higher values indicate fewer restrictions on financial freedom. Fewer official impediments to bank operations and entry could stimulate efficiency and diversification and

[15] This study assigns unrestricted activity a value of zero, permitted activities a value of one, restricted activity a value of two, and prohibited activities a value of three.

could thereby promote stability. Conversely, greater financial freedom could induce destabilizing competition. Therefore, an ambiguous effect is expected.

Deposit insurance is a dummy variable that takes a value of one if a country has explicit deposit insurance and a value of zero otherwise. Credible deposit insurance can enhance financial stability by decreasing the likelihood of depositor runs. Conversely, if the capital positions and risk taking of insured institutions are not supervised carefully, insurers tend to accrue loss exposures that undermine bank stability in the long run.

Institutional and external governance variables

Economic freedom is a time-variant composite index of ten single freedoms: business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, and labor freedom. For each category, a grade on a scale from 0 to 100 is assigned. The ten component scores are then averaged to provide an overall economic freedom score for each country. A higher value indicates greater freedom. To the extent that greater freedom allows banks to improve efficiency by providing different services and thus diversifying their risk, an increased level of freedom is expected to support a bank's financial soundness. In contrast, if greater freedom allows banks to undertake greater risks, and particularly if existing regulations promote risk-taking incentives, greater freedoms overall may lead to greater bank fragility.

The *KKZ index* is an aggregative index of six dimensions of institutional development, including voice and accountability, government effectiveness, political stability, regulatory quality, rule of law, and control of corruption. Better institutional development is expected to yield more mature markets and enhance bank stability.

Finally, the protection of *property rights* is an important pre-requisite for a well-functioning financial system. Property rights are measured as 100 minus the average value for the period 1997-2007 on the property rights protection index. A higher value signifies stronger protection of property rights.

4. Data

The sample data focus on commercial banks in 14 Asia Pacific economies for the period between 2003 and 2009. Financial information and stock market information, converted to US dollars, are obtained from the Bankscope database by Bureau van Dijk and are supplemented by information from the

Datastream database by Thompson Financial Limited. The concentration ratios are obtained from the updated version of the World Bank database on financial development structures; real GDP growth data are taken from the World Economic Outlook by the International Monetary Fund (IMF); and data for regulations and the institutional environment come from several sources, including the World Bank database on "Bank Regulation and Supervision" (developed by Barth et al. (2001) and updated by Barth et al. (2006, 2008)) and Kaufman et al. (2010), as well as the 2009 Index of Economic Freedom, which was published by The Wall Street Journal and The Heritage Foundation.

After excluding banks with (1) missing, negative or zero values for the inputs w_1 and w_2, (2) missing values for loan loss provisions, and (3) missing Z-score values, we obtain a final sample that includes unbalanced panel data for 14 Asia Pacific economies, with 3369 bank observations (see Appendix 1). The subsample for listed banks includes 1252 observations (see Appendix 2). All of the data are deflated by their corresponding year CPIs to the 2003 price level to control for inflation effects. Table 1 presents the descriptive statistics for all variables used in the study. All bank-level variables are averaged by bank for the period from 2003 to 2009, and the country-level variables are averaged by country for the same study period. The average bank in the sample has a probability of bankruptcy of 0.37, a Z-score of 30.59, a Lerner index of 0.38, a log total asset value of 15.58, a loan loss provision ratio of 0.02, and a net interest margin of 0.03. Furthermore, the average concentration ratio is 52.39% in the Asia Pacific banking markets.

(Table 1 inserted here)

5. Empirical results

Table 2 presents the average results for concentration, competition, and bank stability for the period from 2003 to 2009 for 14 Asia Pacific countries by year (panel A) and by country (panel B). Based on both accounting and market measures of bank stability, bank risk increased overall from 2003/2004 to 2007/2008. The Z-score results indicate that the worst year in this respect was 2008. However, the market-based risk measure suggests that the highest probability of bankruptcy occurred in 2009, possibly because each bank's stock returns in the previous year are used to calculate the bank's probability of bankruptcy. The results imply that 2009/2010 may have been a turning point for banks in Asia Pacific, as also suggested by the IMF findings (2009). It would seem that this region was initially hit extremely hard by the global crisis but has rapidly rebounded and is now leading the world out of recession.

Comparing bank risk by country using different methods yields different results. The market-based risk measure indicates that on average, banks operating in Malaysia, Hong Kong, and Singapore are exposed to lower risk potential than are the banks in the other Asia Pacific economies. According to the accounting-based risk measure, banks in Singapore, Indonesia, and Australia are the most stable ones on average. Meanwhile, both risk measures suggest that banks in Japan and Taiwan are the most fragile ones.

When the findings regarding market power are compared by year, the structural and non-structural measures reveal different trends. The overall trend within the Lerner index (a non-structural measure) is descending except in 2009, whereas concentration (a structural measure) increased, especially during the period from 2008 to 2009. The Lerner index exhibits varying degrees of market power across countries. Australia has the highest Lerner index value (0.6589), whereas Sri Lanka has the lowest value (0.0428). The average Lerner index value is 0.3798, indicating a price mark-up of approximately 37.98% over the marginal costs in the Asia Pacific banking markets. Concentration also varies across countries. The results suggest that the concentration of the assets held by the three largest banks in Singapore is 94.46%, which indicates that the assets in the banking sector are almost completely controlled by these banks. However, the concentration of the assets held by the three largest banks in Taiwan is quite low at 27.86%, which indicates that the assets in the banking sector are diversified.

(Table 2 inserted here)

Tables 3 and 4 present the main results that indicate the impact of bank concentration and competition on financial stability. Two different risk exposure indicators are used as the dependent variables that proxy for financial stability: the probability of bankruptcy for listed banks (Table 3) and the Z-score for both listed and non-listed banks (Table 4). For listed banks in particular, Tobit regression models are used because the probability of bankruptcy will be between zero to one. For both listed and non-listed banks, the feasible generalized least squares (FGLS) approach is used, controlling for heteroskedasticity across panels because the variance of each bank is different. Each table includes four regressions. Regression (1) reports the regression results for the impact of bank concentration and competition on bank insolvency risk. Regression specifications (2) - (3) separate concentration and competition to determine the robustness of the results of Regression (1). Regression (4) further assesses the impact of the 2008 financial crisis on the relationship between market power and overall

bank risk. All of the regressions passed the Wald test, a measure of the true value of a parameter based on the sample estimate.[16]

Based on market measures, Table 3 indicates the significantly positive correlation at the 1% level for the Lerner index used in regression (1), suggesting that increases in the degree of bank pricing power are positively related to individual bank stability in Asia Pacific.[17] Meanwhile, the coefficient of bank concentration is significantly negative, indicating that banks in more concentrated markets face greater risk. Furthermore, the coefficient of bank size is significantly positive, suggesting that larger banks face greater risk. The robustness of the results is verified using regression specifications (2) - (4). The findings lend support to the neutral view of the competition-stability nexus both the competition-stability theory and the competition-fragility theory can be simultaneously valid. In this case, excessive concentration and lower pricing power simultaneously lead to bank fragility.[18]

On the one hand, most countries in this region (developing countries in particular) have adopted the "finance for growth" policy, which means that resource allocation has been "policy or state-directed" for a long period. The protected, larger banks in these concentrated banking systems channel resources to "priority sectors" such as exports, industrialization, and infrastructure. Consequently, the more credit the larger banks provide to the larger borrowers, the more they lose their capacity to screen projects properly to determine their quality. Their borrowers become "too large to fail", and hence, banks lose their incentive to develop an appropriate credit culture and may find themselves faced with a large amount of non-performing loans. In addition, banks are the most important sources of public savings in the majority of the Asia Pacific economies, which also makes them "too large to fail" from a public policy point of view. Ultimately, in implicitly guaranteeing that they will support their banks, governments encourage banks to undertake risks that they might not have incurred without such support (Sheng, 2009).

(Table 3 inserted here)

[16] This study also uses a quadratic term for the Lerner index (i.e., $LERNER^2$) to capture a possible non-linear relationship between bank competition and stability. The coefficient of the quadratic terms is significantly negative for the probability of bankruptcy model and positive for the Z-score model. Based on the inflection points calculated, the results remain unchanged. These tables are available on request.

[17] The Lerner index is also averaged across banks for each country in each year to measure banking market competition. The results are nearly the same. The only difference is that the coefficient of bank size is no longer significant in the market-risk based model. The results are not reported here because one can derive more insightful findings from the models using the bank-specific Lerner index for banks in the Asia Pacific region. However, the results are available upon request.

[18] Following Berger et al. (2009) and others, this study also employs two regulatory and institutional variables (activity restriction and economic freedom) as the instrumental variables in the Generalized Method of Moments model to address the likely endogeneity of measures of concentration and competition. The results remain the same except that the coefficients of LLP and NIM are no longer significant when the market-based risk measure is used.

On the other hand, according to Elzinga and Mills (2011), the Lerner index is a "better indicator of a firm's price-setting discretion than its ability to sustain monopoly prices" (p. 1). Thus, the results imply that many banks in this region are able to obtain greater discretion in terms of price-setting to boost their profits and reduce their insolvency risk through channels other than increased concentration (e.g., product differentiation). For example, as indicated in a survey report provided by the IDC Financial Insights Asia/Pacific division, banks across the Asia Pacific region are considering the uniquely Asian opportunities for sustainable growth that have been generated by governments identifying new priority industries such as aerospace and defense in Singapore, green technology in China, and high technology in Taiwan and China. Banks in this region have identified two strategic technology initiatives that they can use to expand their reach and profitability - risk management and channel efficiency. The focus on risk management has mainly been generated by the growing availability and sophistication of analytics technologies, whereas the emphasis on channel efficiency stems from the vast expansion of mobility across the region. As a result, there are a growing number of innovative strategic IT projects that drive business differentiation in Asia Pacific banks (IDC, 2012). Consequently, greater pricing power enhances the ability of banks to generate higher "capital buffers" to protect them against external macroeconomic and liquidity shocks.

Among other control variables, the positive and significant coefficient for loan loss provisions (LLP) suggests that lower asset quality erodes financial soundness. The net interest margin (NIM) is negatively and significantly related to bank risk, which indicates that the profitability of a bank's interest activities positively impacts bank stability. Higher GDP growth (RGDP) encourages more stable banking markets. Finally, the significantly positive coefficient for the crisis dummy (CRISIS) implies that banks are more fragile during financial turmoil.

Table 4 examines the impact of bank concentration and competition on the soundness of both listed and non-listed banks, using the Z-score as a proxy for financial stability. When the accounting-based risk measure is used, the results of regressions (1) - (3) show that the Lerner index is positively and significantly related to the Z-score, implying that a higher degree of pricing power lowers bank risk. Moreover, the coefficient of concentration is not significant, which reflects the lack of relationship between concentration and bank stability. The findings regarding the control variables generally confirm those derived from the market-based models mentioned above.

(Table 4 inserted here)

This study includes a wide variety of sensitivity analyses that control for different regulatory and institutional environments to further investigate the effect of market power on bank stability. Tables 5

and 6 present the coefficient estimates for the sensitivity analyses with the probability of bankruptcy and the Z-score included as the dependent variables, respectively. Both tables illustrate the significantly negative relationship between the degree of pricing power and bank insolvency risk measured using both market- and accounting-based measures. Concentration has a positive impact on the probability of bankruptcy and no impact on a bank's Z-score. Most of the bank-specific and macroeconomic control variables have the same sign as shown in tables 3 and 4.

(Table 5 inserted here)

In considering regulatory and institutional environments, we find that economic and financial freedom, which indicate the general openness and competitiveness of economic and banking systems, are positively and significantly related to the Z-scores. Thus, countries with less government intervention in economic and banking systems are less likely to experience financial instability. According to New Classical Macroeconomics, firms are viewed as optimizers that maximize profits. In this way, they differ from governments, whose purpose is to maximize social benefits. Hence, in accounting data, government intervention may be shown to reduce profits and cause financial instability. Conversely, economic and financial freedoms are positively and significantly related to the probability of bankruptcy in Keynesian economics. Most Asian countries are developing countries with imperfect economic and financial systems. Keynesian economics suggests that government intervention could eliminate such imperfections and improve market efficiency. Governments use monetary and fiscal policies to guide the development of economic and banking systems, decrease the fluctuations in capital markets and enhance investor confidence. Thus, based on the Black-Scholes model, the results indicate that active government intervention leads to financial stability.

(Table 6 inserted here)

KKZ is negatively and significantly related to the probability of bankruptcy and positively and significantly related to the Z-scores. The results suggest that better institutional development leads to financial soundness, consistent with the findings of Beck et al. (2006a). Property rights are negatively and significantly related to the Z-score, which indicates that stronger protection of property rights leads to financial fragility. Entry restrictions are significantly and negatively associated with the probability of bankruptcy, which suggests that a lower level of competitive pressure induces greater fragility for listed banks. This result is consistent with the empirical findings of Uhde and Heimeshoff (2009), which suggest that restricted market entry is likely to reduce bank stability for Eastern European banking markets. The minimum capital requirements are positively and significantly linked with the Z-scores, suggesting that higher minimum capital requirements enhance financial stability.

This finding is consistent with the results presented by Laeven and Levine (2009). The minimum capital requirements are negatively related to the probability of bankruptcy, but these results are not significant. Deposit insurance is significantly associated with lower Z-scores, which supports the popular argument regarding excessive risk-taking when a financial safety net is available. Again, this result is consistent with the findings of Laeven and Levine (2009).[19]

6. Conclusions

This study investigates the competition-stability nexus using cross-country data from 14 Asia Pacific countries for the period from 2003 to 2009. Both market-based and accounting-based risk measures are employed to measure individual bank fragility for the first time. Meanwhile, both concentration and competition indicators are included in the models to determine their impacts on bank stability. The initial results show a substantial shift in the average risk exposure of banks over the entire sample period, accompanied by gradual increases in concentration and competition. The main results not only highlight the significant negative association between the Lerner index and individual bank risk but also illustrate the significant positive relationship between the concentration ratio and bank stability. In other words, the findings provide support for the neutral view of the competition-stability nexus, indicating that the competition-stability and competition-fragility theories can be simultaneously applicable to the Asia Pacific banking markets. The results also confirm that bank concentration is an insufficient measure of bank competitiveness. The results hold when we control for a wide array of bank-specific, macroeconomic, regulatory and institutional factors.

In addition, the analyses indicate that smaller bank size, higher asset quality, and higher net interest margins improve financial soundness. Although banks are more fragile during financial turmoil, higher GDP growth encourages more stable banking markets. In terms of regulations and institutions, all of the results show that better institutional development and stringent capital requirements yield more mature markets and enhance bank stability, whereas property rights and deposit insurance negatively influence financial soundness. Moreover, freedom for economic and banking systems can have both positive and negative consequences. Listed banks seem to use greater freedom to undertake greater risks, whereas non-listed banks use greater freedom to improve risk diversification.

The findings highlight several important issues for policymakers in Asia Pacific economies. First, to prevent excessive concentration, regulators should adopt a prudent approach to evaluating merger and acquisition applications. One the other hand, policymakers should reduce policy lending by allowing

[19] This study also employs logit models to estimate the relationship between bank concentration, competition, and financial stability. The specification test results indicate that the Tobit models are preferable to the logit models. The tables are available upon request.

and encouraging banks to develop a strong independent credit culture. Second, to improve the efficiency of resource allocation within an economy, regulators should encourage financial innovation among banks based on the premise of effective risk management, which also enables banks to become more stable via product differentiation. Third, policymakers should stimulate institutional development, which can enhance bank stability in this region. Finally, policies associated with deposit insurance schemes should take this important factor into consideration, noting that they may introduce moral hazard and risk shifting into the banking systems in Asia Pacific.

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Table 1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Probability of bankruptcy	1252	0.37	0.39	0	1
Z-score	3369	30.59	35.91	-39.07	518.78
CR3	3369	0.52	0.16	0.26	1
Lerner index (LERNER)	3369	0.38	0.14	-0.12	0.70
Bank size (SIZE)	3369	15.58	1.94	9.7	21.36
Loan loss provision (LLP)	3369	0.02	0.03	0	0.98
Net interest margin (NIM)	3369	0.03	0.02	-0.24	0.23
Real GDP growth (RGDP)	3369	0.05	0.04	-0.06	0.14
Total entry denied	3369	0.07	0.2	0	0.92
Activity restrictions	3369	7.97	2.75	1	12
Capital requirements	3369	0.08	0.01	0.08	0.12
Financial freedom	3369	43.8	16.69	30	90
Deposit insurance	3369	0.7	0.46	0	1
Economic freedom	3369	63.28	10.6	51.2	90
Institutional development (KKZ index)	3369	58.95	23.41	17.73	93.74
Property rights	3369	52.75	21.6	20	90

The probability of bankruptcy is a market-based bank-level measure of financial fragility that is calculated using the method developed by Bharath and Shumway (2008). The Z-score is an accounting-based bank-level indicator of financial stability. The Lerner index (LERNER) is a bank-level indicator of bank competition that is calculated as the difference between price and marginal cost as a percentage of price. CR3 is a country-level structural indicator of bank concentration that is calculated as the fraction of assets held by the three largest banks in each country. SIZE is the natural logarithm of total assets in thousands of USD. LLP is the ratio of loan loss provisions to total assets. NIM is the ratio of net interest income to interest-bearing (total earning) assets. RGDP is the rate of real GDP growth. Total entry denied is the ratio of entry applications denied to applications received from domestic and foreign banks. Activity restrictions are aggregate index measures that indicate whether bank activities in the securities, insurance and real estate markets and the ownership and control of non-financial firms are unrestricted, permitted, restricted or prohibited. The capital requirement is the minimum regulatory capital-to-assets ratio per country. Financial freedom is an indicator of the openness of the banking system; it functions as a composite index of government interference in the financial sector, including regulations on financial products, allocation of credit, whether foreign banks are free to operate and other factors. Deposit insurance is a dummy variable that takes a value of one if the country has deposit insurance and a value of zero otherwise. Economic freedom is the degree of freedom from government interference afforded to businesses and individuals. Institutional development (KKZ index) is an index of the level of institutional development based on six dimensions of governance. Property rights are measured using the Heritage Foundation property rights protection index.

Table 2: Estimation results for the degree of concentration, competition, and stability

	Obs.	CR3	LERNER	Z-score	Obs.	Prob. of bankruptcy
Panel A: mean by year						
2003	398	0.49	0.39	30.67	146	0.36
2004	441	0.47	0.40	31.82	161	0.15
2005	484	0.47	0.39	31.00	176	0.18
2006	511	0.47	0.39	31.10	179	0.15
2007	537	0.53	0.38	30.35	190	0.41
2008	515	0.58	0.35	28.93	195	0.43
2009	483	0.65	0.38	30.46	205	0.84
Panel B: mean by country						
Australia	94	0.65	0.66	36.35	42	0.19
China	553	0.68	0.50	30.01	28	0.53
Hong Kong	162	0.77	0.56	29.43	28	0.15
India	305	0.33	0.32	31.82	147	0.32
Indonesia	365	0.56	0.23	37.11	117	0.25
Japan	880	0.45	0.36	29.79	526	0.47
Korea	109	0.50	0.34	25.31	27	0.32
Malaysia	163	0.45	0.48	35.08	21	0.13
Pakistan	145	0.47	0.23	13.15	81	0.22
Philippines	149	0.65	0.20	33.67	68	0.30
Singapore	48	0.94	0.40	47.46	14	0.19
Sri Lanka	70	0.62	0.04	28.49	47	0.33
Taiwan	202	0.28	0.36	26.86	50	0.52
Thailand	124	0.48	0.63	29.82	56	0.38

The probability of bankruptcy is a market-based, bank-level measure of financial fragility that is calculated using the method developed by Bharath and Shumway (2008). The Z-score is an accounting-based, bank-level indicator of financial stability. The Lerner index (LERNER) is a bank-level indicator of bank competition that is calculated as the difference between price and marginal cost as a percentage of price. CR3 is a country-level structural indicator of bank concentration that is calculated as the fraction of assets held by the three largest banks in each country.

Table 3: Concentration, Competition, and Probability of Bankruptcy

	(1)	(2)	(3)	(4)
LERNER	-0.3314***	-0.3677***		-0.2345***
	(0.0763)	(0.0773)		(0.0765)
CR3	0.8583***		0.8999***	0.6602***
	(0.1313)		(0.1320)	(0.1329)
SIZE	0.0194**	0.0195**	0.0083	0.0114
	(0.0088)	(0.0090)	(0.0085)	(0.0088)
LLP	1.5036**	1.2989**	1.7593***	1.6376***
	(0.6285)	(0.6383)	(0.6304)	(0.6188)
NIM	-0.0175*	-0.0214**	-0.0296***	-0.0243**
	(0.0101)	(0.0103)	(0.0098)	(0.0100)
RGDP	-0.0481***	-0.0691***	-0.0489***	-0.0234***
	(0.0048)	(0.0037)	(0.0049)	(0.0061)
CRISIS				0.2052***
				(0.0320)
CONSTANT	-0.3700*	0.3085*	-0.3816*	-0.2719
	(0.1943)	(0.1671)	(0.1958)	(0.1918)
Observation	1252	1252	1252	1252
Wald χ^2	649.51***	586.77***	621.26***	711.78***

This table presents the results of the fixed-effect Tobit regression models, which indicate the implications of bank concentration and competition for financial stability as measured by the probability of bankruptcy after bank-specific and macroeconomic variables have been controlled for. The dependent variable is the probability of bankruptcy of each bank. The Lerner index (LERNER) is a bank-level indicator of bank competition that is calculated as the difference between price and marginal cost as a percentage of price. CR3 is a country-level structural indicator of bank concentration that is calculated as the fraction of assets held by the three largest banks in each country. SIZE is the natural logarithm of total assets in thousands of USD. LLP is the ratio of loan loss provisions to total assets. NIM is the ratio of net interest income to interest-bearing (total earning) assets. RGDP is the rate of real GDP growth. CRISIS is a financial crisis dummy that takes a value of one for 2008-2009 and zero otherwise. Specification (1) is the baseline regression. Specification (2) excludes CR3, and specification (3) excludes Lerner. Specification (4) adds CRISIS to the baseline regression. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Robust standard errors are in parentheses.

Table 4: Concentration, Competition, and Z-scores

	(1)	(2)	(3)	(4)
LERNER	18.5778***	18.3303***		18.5715***
	(1.0041)	(1.0019)		(1.0067)
CR3	1.8347		0.6243	1.5893
	(2.1810)		(2.3717)	(2.2044)
SIZE	-0.4142***	-0.4067***	-0.4613***	-0.3992***
	(0.1159)	(0.1154)	(0.1077)	(0.1159)
LLP	-40.9751***	-40.7723***	-50.0955***	-40.3800***
	(7.8095)	(7.7314)	(8.4587)	(7.7836)
NIM	0.3857***	0.3835***	0.3857***	0.3758***
	(0.1139)	(0.1133)	(0.0613)	(0.1138)
RGDP	0.1057	0.0743	0.1775**	0.1251
	(0.0683)	(0.0535)	(0.0741)	(0.0898)
CRISIS				0.0795
				(0.4325)
CONSTANT	27.1571***	28.4892***	39.9985***	26.9795***
	(2.8755)	(2.3752)	(2.7353)	(2.8663)
Observation	3369	3369	3369	3369
Wald χ^2	3350.92***	3348.01***	2241.44***	3430.73***

This table presents the results of the fixed effect FGLS regression models, which indicate the implications of bank concentration and competition on financial stability as measured using the Z-scores after bank-specific and macroeconomic variables are controlled for. The dependent variable is the Z-score of each bank. The Lerner index (LERNER) is a bank-level indicator of bank competition that is calculated as the difference between price and marginal cost as a percentage of price. CR3 is a country-level structural indicator of bank concentration that is calculated as the fraction of assets held by the three largest banks in each country. SIZE is the natural logarithm of total assets in thousands of USD. LLP is the ratio of loan loss provisions to total assets. NIM is the ratio of net interest income to interest-bearing (total earning) assets. RGDP is the rate of real GDP growth. CRISIS is a financial crisis dummy that takes a value of one for 2008-2009 and a value of zero otherwise. Specification (1) is the baseline regression. Specification (2) excludes CR3, and specification (3) excludes Lerner. Specification (4) adds CRISIS to the baseline regression. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Robust standard errors are in parentheses.

Table 5: Probability of Bankruptcy vs. Regulatory and Institutional Environment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LERNER	-0.2769***	-0.3366***	-0.3312***	-0.3174***	-0.3353***	-0.3241***	-0.2743***	-0.3350***
	(0.0777)	(0.0755)	(0.0763)	(0.0765)	(0.0763)	(0.0765)	(0.0761)	(0.0765)
CR3	0.7398***	0.9883***	0.8712***	0.8711***	0.8515***	0.8548***	0.6969***	0.8665***
	(0.1355)	(0.1326)	(0.1357)	(0.1313)	(0.1314)	(0.1313)	(0.1331)	(0.1319)
SIZE	0.0168*	0.0187**	0.0193**	0.0176**	0.0195**	0.0189**	0.0166*	0.0196**
	(0.0088)	(0.0087)	(0.0088)	(0.0089)	(0.0088)	(0.0088)	(0.0087)	(0.0088)
LLP	1.6077**	1.4719**	1.5356**	1.4607**	1.4580**	1.5307**	1.7512***	1.5240**
	(0.6265)	(0.6223)	(0.6342)	(0.6280)	(0.6296)	(0.6287)	(0.6228)	(0.6292)
NIM	-0.0173*	-0.0192*	-0.0181*	-0.0192*	-0.0179*	-0.0177*	-0.0202**	-0.0178*
	(0.0101)	(0.0100)	(0.0102)	(0.0101)	(0.0101)	(0.0101)	(0.0100)	(0.0101)
RGDP	-0.0468***	-0.0402***	-0.0477***	-0.0479***	-0.0481***	-0.0484***	-0.0464***	-0.0477***
	(0.0048)	(0.0050)	(0.0050)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0049)
Economic Freedom	0.0138***							
	(0.0041)							
KKZ		-0.0217***						
		(0.0043)						
Property Rights			-0.0015					
			(0.0040)					
Total Entry Denied				-0.2626*				
				(0.1364)				
Activity Restrictions					0.0473			
					(0.0437)			
Capital Requirement						-0.0760		
						(0.0694)		
Financial Freedom							0.0072***	
							(0.0013)	
Deposit Insurance								-0.0459
								(0.0729)
CONSTANT	-1.3879***	1.5445***	-0.2421	-0.3534*	-0.6544**	0.2448	-0.8938***	-0.3791*
	(0.3611)	(0.4276)	(0.3921)	(0.1942)	(0.3268)	(0.5944)	(0.2146)	(0.1948)
Wald χ^2	666.4***	687.7***	649.7***	655.1***	651.3***	651.3***	694.9***	650.1***

Results of the fixed-effect Tobit models that explain the competition-stability relationship. The dependent variable is the bank-level probability of bankruptcy.

Table 6: Z-scores vs. Regulatory and Institutional Environment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LERNER	19.1896***	18.6838***	18.6122***	18.7887***	18.7134***	17.6029***	17.9206***	17.6728***
	(1.0098)	(1.0016)	(1.0010)	(1.0141)	(1.0051)	(1.0425)	(1.0095)	(1.0313)
CR3	-0.7924	0.2560	1.9697	2.1450	1.9660	1.8937	0.7502	2.4051
	(2.3350)	(2.0428)	(2.1996)	(2.1909)	(2.1708)	(2.1949)	(2.2690)	(2.2037)
SIZE	-0.4013***	-0.4773***	-0.3959***	-0.4363***	-0.4221***	-0.3636***	-0.4297***	-0.3714***
	(0.1163)	(0.1169)	(0.1163)	(0.1167)	(0.1160)	(0.1187)	(0.1166)	(0.1175)
LLP	-40.8542***	-37.4350***	-37.9121***	-44.6236***	-40.1063***	-42.5039***	-40.7824***	-41.6482***
	(7.5844)	(7.7588)	(7.7626)	(8.1274)	(7.8432)	(7.8361)	(7.8751)	(7.9909)
NIM	0.3839***	0.4340***	0.3409***	0.3982***	0.3824***	0.3839***	0.4193***	0.3849***
	(0.1129)	(0.1164)	(0.1133)	(0.1166)	(0.1132)	(0.1140)	(0.1129)	(0.1149)
RGDP	0.0988	-0.0170	0.1403**	0.1087	0.1006	0.1297*	0.1129	0.1363**
	(0.0701)	(0.0698)	(0.0690)	(0.0685)	(0.0682)	(0.0691)	(0.0708)	(0.0694)
Economic Freedom	0.2679***							
	(0.0744)							
KKZ		0.3857***						
		(0.0658)						
Property Rights			-0.1647***					
			(0.0591)					
Total Entry Denied				-2.4372				
				(1.6310)				
Activity Restrictions					-0.4552			
					(0.4648)			
Capital Requirement						3.0261***		
						(0.7989)		
Financial Freedom							0.0558**	
							(0.0220)	
Deposit Insurance								-3.1415***
								(0.9907)
CONSTANT	6.6578	-6.1657	41.4882***	27.2248***	29.9512***	2.4885	23.4612***	26.4197***
	(6.4459)	(6.6151)	(5.9260)	(2.8816)	(4.0224)	(7.0595)	(3.4667)	(2.8967)
Wald χ^2	3439***	3522***	3432***	2785***	3469***	3274***	3245***	3190***

Results of the fixed-effect FGLS models, which indicate the competition-stability relationship. The dependent variable is the bank-level Z-score.

Appendix 1: Number of both listed and non-listed banks in the sample

	2003	2004	2005	2006	2007	2008	2009	Total
Australia	7	8	12	17	19	18	13	94
China	45	53	70	90	110	99	86	553
Hong Kong	11	25	27	26	26	24	23	162
India	42	45	40	44	48	45	41	305
Indonesia	47	51	54	55	56	53	49	365
Japan	131	128	126	125	127	124	119	880
Korea	15	16	17	16	15	15	15	109
Malaysia	22	23	24	24	24	23	23	163
Pakistan	16	17	21	20	24	24	23	145
Philippines	13	21	24	24	22	22	23	149
Singapore	4	5	8	8	8	7	8	48
Sri Lanka	8	10	10	11	10	10	11	70
Taiwan	21	23	34	32	29	31	32	202
Thailand	16	16	17	19	19	20	17	124
Total	398	441	484	511	537	515	483	3369

Source: BankScope (Bureau Van Dijk)

Appendix 2: Number of listed banks in the sample

	2003	2004	2005	2006	2007	2008	2009	Total
Australia	7	8	12	17	19	18	13	94
China	45	53	70	90	110	99	86	553
Hong Kong	11	25	27	26	26	24	23	162
India	42	45	40	44	48	45	41	305
Indonesia	47	51	54	55	56	53	49	365
Japan	131	128	126	125	127	124	119	880
Korea	15	16	17	16	15	15	15	109
Malaysia	22	23	24	24	24	23	23	163
Pakistan	16	17	21	20	24	24	23	145
Philippines	13	21	24	24	22	22	23	149
Singapore	4	5	8	8	8	7	8	48
Sri Lanka	8	10	10	11	10	10	11	70
Taiwan	21	23	34	32	29	31	32	202
Thailand	16	16	17	19	19	20	17	124
Total	398	441	484	511	537	515	483	3369

Source: BankScope (Bureau Van Dijk)