# Bank Market Power and Risk Taking: Evidence from Asia

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## Abstract

The aim of this paper is to investigate the link between market power in banking industry and bank risk taking in the Asian context, a region where bank moral hazard becomes one of main concerns for policy makers. Based on a broad set of Asian banks for the period 2001-2007, our results indicate that market power increases bank risk. We also find that a higher degree of market power in the banking industry is associated with an increase in bank's total capital ratios. Our findings show that although banks hold higher capital ratios to absorb losses in less competitive markets - a result which is consistent with Berger et al (2009) who consider a sample of developed economies- the levels of capitalisation are not high enough to offset the impact on default risk of higher risk taking.

**JEL Classification**: G21, G28, L11

**Keywords**: bank market power, capital ratio, moral hazard, Asian banks

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## 1 Introduction

Asian countries have undergone dramatic economic changes over the last two decades. They have swung from expansionary financial liberalisation to a severe crisis in 1997. Institutional problems were perceived as the origin of such a financial turmoil. Those include corporate sector vulnerability due to weak corporate governance, and the unsupervised financial liberalisation of the 1980s that has resulted in unfettered competition on the credit market, notably in the real estate markets (Sachs and Woo, 2000).

In the aftermath of the 1997 Asian crisis, despite the fact that Asian firms have attracted foreign investment, firms still face corporate governance problems, poor accounting and irregularities, non-transparent management, and a governance system that granted minority shareholders little protection for their interests (Park, 2006). From this channel bank risk becomes again an important issue, since Chang (2004) documents that banking is the predominant source of finance for private sector businesses in Asian countries.

Likewise, several financial reforms, such as bank capitalisations and consolidations, have been implemented to moderate excessive bank competition and to reinforce financial stability[1]. Nevertheless, the effectiveness of such reforms remains questionable. Brana and Lahet (2009) provide evidence that the stringency of bank capital requirements following the 1988 Basel accord in the pre-Asian crisis period played a major role in the capital crunch of Japanese banks and hence shrinking foreign assets held by Japanese banks in Thailand in the 1990s. In regards to bank consolidations, bank mergers and acquisitions have grown rapidly with the growth level reaching 23% per year as of 2003. However, such consolidations do not necessarily build stronger banks. As noted by Cook (2009) consolidation leads to "too big to fail" effects in Asian banks, increasing risk-taking incentives through "gamble for resurrection" strategies to exploit state bailouts and the costs involved in the transfer of losses from shareholders to the taxpayers.

Another contemporary issue in Asia is that the trend of financial globalisation has recently driven Asian banks to evolve both nationally and internationally (Moshirian, 2008). Berger (2003) accentuates that, as banks expand their scope of activities into more various products and identify new growth opportunities across national borders, they are likely to gain market power. Through these channels, moral hazard can also arise and bank supervisors need to raise concern on this issue.

[1] See Williams and Nguyen (2005) and Klingebiel *et al* (2001) for further discussion on the financial reforms in Asian countries.

In spite of the importance of these contemporary issues, to our best knowledge, no evidence has yet been found in the Asian context regarding the implications of such developments on bank risk. The aim of this paper is therefore to assess such issues by investigating the impact of market power in the banking industry on individual bank risk and capitalisation in Asian countries after the 1997 Asian crisis. We consider the period 2001-2007 and a broad set of commercial banks in Asian countries that have been affected by the 1997 Asian financial crisis. These include Indonesia, Malaysia and Thailand that were severely devastated by the banking crisis, as well as China, India, Hong Kong, Pakistan, Philippines, South Korea, Sri Lanka, Taiwan, and Vietnam that were less affected.

The rest of this paper is structured as follows. Section 2 provides a literature review on the relationship between market power and bank risk. Section 3 describes the data, variables and provides descriptive statistics. Section 4 highlights the econometric specification and methodology used in this paper. Section 5 provides a broad set of sensitivity analyses. Section 6 concludes the paper.

## 2. Literature review

The link between bank market power and financial stability has become a lively debate during the last two decades following financial deregulation and crises throughout the world. Marcus (1984) is the first to build a theoretical model by showing that competition on the deposit market drives banks to undertake risk-taking strategies due to the contraction in banks' franchise value. This view is well-known as the "franchise value" hypothesis.

In his theoretical model, Broecker (1990) supports the "franchise value" hypothesis by obtaining a negative relationship between average banks' credit quality and the number of banks in a market. Besanko and Thakor (1996) further highlight that a higher degree of bank competition is associated with a decease in information rents obtained from relationship lending which in turn inceases bank risk taking. Matutes and Vives (1996) show that market power lowers bank default probability, although an imperfect competition framework linked to product differentiation is taken into account.

Keeley (1990) is the first to empirically show that competition in the U.S banking industry in the aftermath of financial deregulation, erodes bank charter value and induces banks to take on more risk. Demsetz et al. (1996) also analyze the U.S banking industry and find that banks with higher market power are the banks with higher solvency ratios and lower asset risk. In a single-country setting, Bofondi and Ghobi (2004) find that the increased number of banks in the Italian banking system worsens the default rate of loans, while

Jimenez et al. (2008) shed light on the negative relationship between the Lerner index and risk taking for Spanish banks. In a cross-country setting, Levy-Yeyati and Micco (2007) find a negative impact of competition on bank stability in Latin American countries.

While the empirical literature mainly reports the effect of bank competition on bank risk taking, Beck et al. (2006) emphasise the effect of bank concentration on the probability of banking crises. Studying 69 countries during the period 1980-1997, they find that banking crises are less likely to occur in a more concentrated banking system. In the case of Rusian banks, Fungáčová and Weill (2009) find that a higher degree of bank competition is associated with an increase in bank failures. In the case of developing countries over the period 1999-2005, Turk-Ariss (2010) finds that greater bank market power enhances bank stability and profit efficiency, although it also deteriorates cost efficiency.

In spite of a growing literature supporting the "franchise value" hypothesis, Boyd and De Nicolo (2005) offer another view known as the "competition-stability" hypothesis. They show that bank market power in the deposit market induces banks to increase the cost of borrowing for entrepreneurs. As a result, such a strategy increases entrepreneurial moral hazard to undertake risky projects which in turn increases entrepreneurial default risk. Higher entrepreneurial default risk directly erodes the solvency of banks through the risk-shifting mechanism, as developed by Stiglitz and Weiss (1981).

Boyd et al. (2006) provide evidence that supports the "competition-stability" hypothesis. For a U.S. as well as an international bank sample, it is shown that a higher degree of bank competition is not necessarily associated with an increase in the probability of bank failures. In the case of European banks, Uhde and Heimeshoff (2009) also highlight that bank concentration deteriorates financial stability. This negative effect of bank concentration on financial stability is more severe in the less developed countries of Eastern Europe. The similar trend also occurs in Asia, where Molyneaux and Nguyen-Linh (2008) show that bank competition does not erodes bank stability.

Allen and Gale (2004) argue that the relationship between bank competition and risk can be influenced by asymmetric information. They show that resource allocation in a perfectly competitive market following a Schumpetarian style, i.e. as competition through innovation, is constrained-efficient. Under some conditions, such an efficiency is driven by financial instability (risk taking). Hence, there is likely a trade-off when competition in banking increases. For such reasons, policy makers tend to enforce prudential regulations,

such as capital requirements, instead of enhancing bank consolidation and concentration that in some cases, may induce bank inefficiency[2].

Building on the contribution of Hellmann et al (2000), Repullo (2004) constructs a dynamic model of imperfect competition where banks have two choices of investment, i.e a safe asset and a gambling asset. It is shown that when bank competition increases, only the gambling equilibrium exists. In this case, capital requirements can play a crucial role to ensure the existence of prudent equilibrium, if the cost of raising capital exceeds the return of the prudent assets. Hence, capital requirement only affects deposit rates to maintain bank charter value. Moreover, if capital requirement is weighted by asset risk, there is no cost of capital for ensuring the existence of prudent equilibrium.

Using 543 banks operating in 13 Central and East European (CEE) countries over the period 1998-2005, Agoraki et al. (2009) find that capital requirements reduce risk in general, but for banks with higher market power this effect is significantly weaker or can be reversed. In other words, strict capital requirement should not be imposed in banks with higher market power, since it may erode bank charter value. Based on 421 commercial banks from 61 countries, Behr et al. (2009) also show that, after controlling for financial development, legal system efficiency, and several individual bank and country-specific variables, the effectiveness of capital requirements to reduce bank risk taking only occurs in banking markets with a lower degree of concentration. Such evidence reflects that bank concentration has already facilitated banks to reinforce their charter value and hence, increasing banks' capital ratio (Berger et al., 2009). Therefore, the enforcement of non-binding capital requirements in well-capitalized banks can deteriorate bank stability due to a decrease in the monitoring intensity and the amount of capital held by the banks (Blum, 2003).

To our best knowledge, only few studies that have sought to integrate bank capital ratios into the nexus between bank competition and financial stability. While Schaeck and Cihak (2007) show that banks in a more competitive market tend to hold higher capital ratios as "*peer market discipline*" tools, Berger et al. (2009) find the opposite result.

[2] For a single-country study, see Kumbhakar et al. (2001) or Isik and Hassan (2003) who show that a higher degree of competition due to financial deregulation is associated with an increase in bank performance as banks improve their efficiency through operational savings. For a cross-country study, Brissimis et al (2008) show that financial deregulation in ten newly acceded countries in Europe increases banking competition and is followed by an increase in bank efficiency. Meanwhile, Agoraki et al. (2009) discuss two channels in which capital requirements can moderate bank competition. First, higher capital requirements can impose entry barriers for new banks, which in turn impedes competition. As a consequence, existing banks can maintain their franchise value and behave prudently. Second, higher capital requirements are associated with an increase in fixed costs to run the banks. Thus, only a limited number of banks can afford these costs

Berger et al. (2009) highlight that the "franchise value" hypothesis and the "competition-stability" hypothesis need not be opposing propositions. Based on 8,235 banks in developed countries, their empirical results suggest that a higher degree of bank market power is associated with an increase in non-performing loans and hence, supporting the "competition-stability" hypothesis. On the other hand, a higher degree of bank market power is also associated with a decrease in bank insolvency risk and hence, highlighting the "franchise value" hypothesis. The latter finding is due to an increase in bank capital ratios when bank market power increases.

In this paper we extend the existing literature by analyzing the impact of banking industry market power on bank insolvency risk, risk taking and capital ratios in the Asian context, a region where bank moral hazard becomes one of main concerns for policy makers. By considering the impact of market power on bank capital ratios, we investigate whether or not the self-disciplining factor gaining from higher market power enhances banks' incentive to moderate excessive risk taking and to hold sufficient capital ratios.

## 3. Data, variables and descriptive statistics

### 3.1 Data

The data used in this paper are taken from several sources. Bank-level data are retrieved from BankScope to construct a sample consisting of an unbalanced panel of annual series for the period 2001–2007. We consider 607 commercial banks established in 12 countries in Asia (China (137), Hong Kong (53), India (74), Indonesia (80), Malaysia (51), Pakistan (30), Philippines (41), South Korea (21), Sri Lanka (14), Taiwan (49), Thailand (23), and Vietnam (34))[3]. Following Agusman et al. (2006) and Laeven (1999) who study Asian banks, we focus only on commercial banks, since commercial banks tend to have more freedom to choose their business mix and face similar restrictions across countries. Country-level data, such as the annual real gross domestic products, the annual gross domestic products per capita, and the annual inflation rate, come from the International Financial Statistics database (IFS) provided by the International Monetary Fund, while the annual countries' financial structure data come from Beck and Demirguc-Kunt (2009).

[3] The distribution of banks is shown in parentheses.

### 3.2 Market power in the banking industry

The most important step in assessing market power or competition in banking industry is the choice of a competition measure. Claessens and Laeven (2004) argue that performance measures such as banks' net interest margin or profitability do not appropriately indicate the competitiveness of a banking industry. These measures can be influenced by a number of factors such as country specific performance and stability, the form and the degree of taxation of financial intermediation, the quality of institutions, and bank-specific factors.

Beck (2008) also highlights that traditional indicators of competition based on market structure and concentration measures, such as the number of banks operating in the industry, the Herfindahl index (HHI index), as well as concentration ratios, are rather crude measures that do not take differentiation strategies into consideration. For instance, banks may not compete directly with each other in the same line of business products. Hence, such indicators only capture the actual market share without allowing inferences on the competitive behaviour of banks.

For such reasons, following Uchida and Tsutsui (2005), we opt for the new industrial organisation approach to quantify the degree of market power in Asian banking. This method allows to estimate a more accurate measure of competition for at least three reasons. First, based on panel data techniques, it provides the estimates of the degree of market power in the banking industry for each period. Second, this type of measure does not require any information on the market structure of each bank. Third, this method allows us to determine the degree of market power endogeneously.

More precisely, we jointly estimate a system of three equations that correspond to a translog cost function, to a bank profit maximization revenue function, and to an inverse loan demand function.(System (1)). In defining revenue, we follow Brissimis et al (2008) using total revenue from both interest and non-interest revenue[4]. This construction allows us to implicitly capture the implications of a shift from interest activities to non-interest activities for bank profitability, a trend which has been observed in most banking systems around the world.

[4] Uchida and Tsutsui (2005) only consider revenue generated by bank loans.

$$
\begin{aligned}
\ln C_{it} &= b_0 + b_1 \overline{\ln q_{it}} + \frac{1}{2} b_2 \left(\overline{\ln q_{it}}\right)^2 + b_3 \overline{\ln d_{it}} + \frac{1}{2} b_4 \left(\overline{\ln d_{it}}\right)^2 + b_5 \overline{\ln w_{it}} + \frac{1}{2} b_6 \left(\overline{\ln w_{it}}\right)^2 \\
&\quad + b_7 \left(\overline{\ln q_{it}}\right)\left(\overline{\ln w_{it}}\right) + b_8 \left(\overline{\ln q_{it}}\right)\left(\overline{\ln d_{it}}\right) + b_9 \left(\overline{\ln d_{it}}\right)\left(\overline{\ln w_{it}}\right) + e_{it}^C \\
R_{it} &= \frac{\theta_t}{\eta_t} R_{it} + r_{it} q_{it} + c_{it} \left(b_1 + b_2 \left(\overline{\ln q_{it}}\right) + b_7 \left(\overline{\ln w_{it}}\right) + b_8 \left(\overline{\ln d_{it}}\right)\right) \\
&\quad + C_{it} \frac{q_{it}}{d_{it}} \left(b_3 + b_4 \left(\overline{\ln d_{it}}\right) + b_8 \left(\overline{\ln q_{it}}\right) + b_9 \left(\overline{\ln w_{it}}\right)\right) + e_{it}^S \\
\ln p_{it} &= g_0 - (1/\eta) \ln q_{it} + g_1 \ln GDPG_t + g_2 \ln OPL_{it} + e_{it}^D
\end{aligned}
\tag{1}
$$

Variables with bars are deviations from their cross-sectional means in each time period to reduce multicollinearity. The degree of competition in each year is given by $\theta_t \in [0,1]$ representing the well-known conjectural variations of elasticity of total industry outputs with respect to the output of bank *i*. In the case of perfect competition, $\theta_t = 0$ ; under pure monopoly, $\theta_t = 1$ ; and finally, $\theta_t < 0$ implies pricing below marginal cost and could result, for example from a non-optimizing behavior of banks. In the special case of Cournot competition, $\theta_{jt}$ is simply the market share bank *i*.

Specifically, $C_{it}$ is measured by total expenses from both interest and non-interest income activities, $q_{it}$ by total earning assets, $d_{it}$ by total deposits and short-term funding, $w_{it}$ by the ratio of operating expenses to total assets, $R_{it}$ by total revenue, $r_{it}$ by the ratio of interest expenses to total deposits, $p_{it}$ by the ratio of total revenue to total earning assets, $GDPG_t$ and $OPL_{it}$ are factors that affect demand, defined as the growth of country-level real gross domestic product (GDP), and the ratio of operating expenses to total loans, respectively.

Following Brissimis et al (2008), we perform country-level estimation and specify the Seemingly Unrelated Regression (SUR) method to solve System (1) . To estimate $\theta_t$ we use annual time dummy variables, while to estimate $\eta$ we use bi-annual time dummy variables (every two years). This is because the values taken by $\eta$ are linearly dependent on the time-specific control variable (*GDPG*) in the third structural equation of System (1). In the subsequent analyses, $\theta_t$ denotes the Lerner index (*LERNER*) of the banking industry in country *j*.

In this paper, we also investigate $LERNER^2$ for capturing the possible non-linearity effect of market power on risk taking. To calculate $LERNER^2$, we set $LERNER^2$ equals to zero if *LERNER* is negative.

### 3.3. Bank risk and capital ratio

In order to measure bank risk we use the Z-score technique. The Z-score indicates the number of standard deviations that a bank's return on assets (*ROA*) has to drop below its expected value before equity is depleted. Thus, a higher Z-score is associated with a decrease in a bank's default probability. For each bank *i* and time *t*, the Z-score index is defined as follows

$$ZROA_{i,t} = \frac{ROA_{i,t} + EQTA_{i,t}}{SDROA_{i,t}}$$

*ROA* is the return on average asset, *EQTA* is the ratio of equity to total assets, and *SDROA* is the standard deviation of bank's *ROA*. Following Agoraki et al. (2009) we compute Z-scores for bank *i* and time *t* that corresponds to the *SDROA* calculated from the two previous years. To ensure the robustness, we also consider the Z-score based on the return on average equity as follows

$$ZROE_{i,t} = \frac{1 + ROE_{i,t}}{SDROE_{i,t}}$$

*ROE* is the return on average equity, while *ZROE* is calculated based on the standard deviation of bank's *ROE* from the two previous years.

Since higher bank insolvency risk can be due to excessive bank risk taking, we also investigate the impact of market power in the banking industry on individual bank risk taking. For this objective, we use *SDROA* and *SDROE* as dependent variables. In addition, we also investigate the effect of market power on bank capitalisation, since bank capital can absorb losses from higher risk taking in less competitive market. To capture bank capitalisation, we consider the ratio of banks' total capital to risk-weighted asset (*CAR*) as dependent variable in order to be consistent with Basel II.

### 3.4. Control variables

First, we control for country-specific effects. Since macroeconomic developments are likely to affect the quality of banks' assets, we follow Schaeck and Cihak (2007) by including the inflation rate (*INF*) and the real gross domestic product growth (*GDPG*)[5].

Second, we control for bank-specific effects. Following Uhde and Heimeshoff (2009), we include the annual banks' loan growth (*LOANG*). The ratio of the loan loss reserves to total loans (*LLR*) is also accounted for following Schaeck and Cihak (2007). Moreover, bank-level risk can also be affected by business differences (deposit to total asset or *DEPO*), loan to total asset (*LOAN*), profitability (*ROE* and *ROA*), inefficiency (operating expenses to total revenue or *OVERHEAD*), leverage differences (equity to total asset or *EQTA*), bank income coming from non-interest income generating activities (non-interest income to total revenue or *NNI*), and bank size (the logarithm of bank's total asset or *SIZE*). Nevertheless, we do not incorporate *LOAN*, *DEPO, ROA* and *NNI* as control variables due to collinearity issues[6].

### 3.5. Data selection

To deal with outliers we impose several restrictions to our dataset. We eliminate the extreme bank/year values of some variables that exhibit left-skewed and/or right-skewed distributions. We clean $w$ and $OPL$ as shown in System (1) by eliminating both their 2.5% lowest and 2.5% highest values. For the link between market power and risk, we eliminate the 2.5% highest values of *ZROA*, since this variables exhibit right-skewed distribution. For *LLR*, we eliminate their values if they are higher than 100% and less than 0. For *OVERHEAD*, we eliminate its 2.5% highest value due to the right-skewed distribution observed.

### 3.6. Descriptive statistics

Table 1 reports descriptive statistics on the "clean" variables used in this paper, while Table 2 show the degree of market power in the banking industry for each country and at each time period.

[5] Following Schaek and Cihak (2007), we also initially consider the logarithm of GDP per capita (*LNGDPCAP*), the stock market capitalisation to GDP (*STOCK*) and the real interest rate (*INTRATE*) to control for the influence of macroeconomic environments. However, we do not include them as control variables due to collinearity issues. *STOCK* is strongly and positively correlated with *LNGDPCAP*, while both of them are correlated with *INF*. Meanwhile *INTRATE* is strongly and positively correlated with *INF*, as the monetary authorities in Asia consider that inflation is a major threat for macroeconomic stability.

[6] *LOAN* is strongly and positively correlated with *DEPO*. Both *DEPO* and *LOAN* are negatively correlated with *SIZE*. Meanwhile, incorporating *LOAN* as control variable reduces significantly the number of observations due to a large number of outliers observed in *LOAN*. In addition, *ROA* is positively correlated with *ROE* and *EQTA*, while *NNI* is correlated with *LOANG*. See Lepetit et al (2008) for the similar issue about the choice of bank-level control variables.

From Table 2, the Indian banking industry exhibits negative market power throughout the sample period which reveals a non-optimizing behavior of banks. Dash and Cristabel (2009) support our findings since they show that Indian banks experienced a sharp increase in the cost-to-income ratio during the period 2003-2008 while profitability has declined. Shanmugam and Das (2004) report that financial reforms during the period 1992-1999 have not helped banks to raise their interest margins. Das et al. (2004) also find that Indian banks were not much differentiated in terms of input or output technical efficiency, and cost efficiency. Such a non-optimizing behaviour of Indian banks might be due to the fact that the Indian banking industry is still dominated by the public sector banks (Dash and Cristabel, 2009).

In Table 1, we have three indicators used as instrumental variables for *LERNER* discussed in the next section. We retrieve the rule of law index (*RLAW*) from Kaufman et al (2008), the ratio of public and private bond market capitalisation to GDP (*BOND*) from Beck and Demirgüç-Kunt (2009), and the economic freedom index (*ECOFREE*) from Heritage Foundation. *ECOFREE* is a composite index of 10 indicators ranking policies in the areas of trade, government finances, government interventions, monetary policy, capital flows and foreign investment, banking and finance, wages and prices, property rights, regulation and black market activity. The index scores from 0 to 100 with higher scores indicating policies being more conducive to competition and economic freedom.

Insert Table 1 and Table 2 here

## 4. Econometric specification and methodology

The main purpose of this paper is to investigate the effect of market power in the banking industry on individual bank risk. Uhde and Heimeshoff (2009) investigate a closely related issue for European banks by studying the relationship between bank concentration and financial stability. Our analysis departs from Uhde and Heimeshoff (2009) by considering the link with market power instead of concentration. We consider that the process of bank consolidation does not necessarily increase bank concentration. However, banking industry is more likely to gain market power after the consolidation process[7].

[7] See DeYoung et al. (2009) for further investivigations on the relationship between bank consolidation and market power.

We construct Equation (2) that has often been used to test the relationship between market power and bank risk taking (Boyd et al, 2006; Brissimis et al, 2008; Agoraki et al, 2009).

$$Y_{ijt} = f\left( LERNER_{jt}, LERNER^{2}_{jt}, X_{jt}, Z_{ijt} \right) \quad (2),$$

where *i*, *j*, *t* are bank, country and time indexes, respectively. $Y_{ijt}$ represents dependent variables consisting of the bank risk and capital ratios measures, while $X_{jt}$ and $Z_{ijt}$ are country-specific and bank-specific control variables, respectively. Moreover, the recent empirical literatures mainly shed light on the endogeneity issue in the nexus between market power and bank risk taking (Berger et al, 2009; Uhde and Heimeshoff, 2009; Gonzales, 2005; Schaeck and Cihak, 2007). In order to take into account this issue, we estimate Equation (2) by specifying instrumental variables.

Claessens and Laeven (2004) argue that the quality of institution that protects shareholders' rights is an important aspect for a well-functioning financial system. According to Moshirian (2009), sharehoders' rights are not effectively protected if the legal system is not well established. Therefore, we consider *RLAW* as one of the instrumental variables which may affect the degree of banking industry market power. Moshirian (2009) further accentuates that the quality of macrogovernance environment related to shareholders' protections will enhance the degree of financial globalisation. If this is the case, higher *RLAW* can reduce banking market power as the competition level of financial system due to financial globalisation increases. Meanwhile, as discussed by Schaeck and Cihak (2007), a well-developed financial market can change the competitive environment in which banks operate. By choosing *BOND* as instrumental variable, we aim to capture the effect of financial market development. For instance, if the bond market is well-developed, an increase in *BOND* might imply that banks can choose to invest their funds on the bond market instead of providing loans to the private sector, notably when market uncertainty is higher. Also, firms can have easier access to the market imposing more competivive pricing for bank loans. Finally, we also consider Economic Freedom (*ECOFREE*) as one of the instrumental variables for *LERNER* instead of using Banking Freedom to be consistent with Berger et al (2009).

To estimate the relationship between market power in the banking industry and individual bank risk with instrumental variables, we employ the Generalized Method of Moments (GMM) with fixed effect corrections[8]. By taking into account individual and time

[8] Berger et al (2009) also use the GMM estimation, while Schaeck and Cihak (2007) and Uhde and Hemishoff (2009) use 2SLS.

fixed effects, we can avoid drawbacks due to omitted variables. In addition, the use of the GMM method has two advantages. This method is robust to the distribution of errors and is considered as more efficient than Two-Stages Least Squares (2SLS) because it accounts for heteroskedasticity (Hall, 2005).

**5. Empirical results**

For investigating the link between market power and bank risk, we proceed into three steps. First, we analyze the relationship between market power and bank insolvency risk. Second, we analyze the impact of market power on bank risk taking and finally, we assess the impact of market power on bank capitalisation. We estimate each link by specifying instrumental variables for market power (*LERNER*). Table 3 shows that our instruments (*RLAW*, *BOND* and *ECOFREE*) are significantly related with market power (*LERNER*) for different model specifications. As well, the significance of three instrumental variables remains consistent for different model specifications as shown in Model 1 to 5 (Table 3). In the case of Asian banks, it seems that a higher bank competition can be driven by better rule of law, a result which is consistent to the view that shareholder protections improves financial globalisation which in turn may increase the degree of competition among banks (Moshirian, 2009). Meanwhile, we denote that bond market capitalisation (*BOND*) and economic freedom (*ECOFREE*) do not necessarily hinder the degree of banking industry market power.

Insert Table 3 here

For assessing the link between market power and bank insolvency risk, Table 4 and 5 shows the results obtained with GMM estimations when we use *ZROA* and *ZROE* as dependent variables, respectivly. It is shown that market power (*LERNER*) is negatively related to both *ZROA* and *ZROE* for different model specifications, while there is no significant impact of $LERNER^2$ on both *ZROA* and *ZROE*. Such relationships indicate that market power in the banking industry increases bank insolvency risk. From Model 5 in both Table 4 and 5, although the number of observations declines significantly, the positive links between market power and bank insolvency risk are not altered. These results may also suggest that our findings do not suffer from possible sample bias.

Insert Table 4 and 5 here

From Table 6 and 7, we also find respectively the positive impact of *LERNER* on both *SDROA* and *SDROE*, while $LERNER^2$ remains insignificant for all model specifications. These findings indicate that higher market power in the banking industry increases bank risk taking. We also still maintain such relationships even if the number of observations declines significantly when we include *SIZE* as control variable (Model 5 in both Table 6 and 7).

Insert Table 6 and 7 here

Moreover, we now investigate whether bank capitalisation is influenced by the degree of market power possibly explaining differences in bank risk taking. More precisely, we investigate the impact of market power in the banking industry on individual bank capitalisation. In Table 8, our results indicate a positive link between *LERNER* and *CAR*, while there is no significant relationship between $LERNER^2$ and *CAR*. These results show that market power facilitate banks to hold higher capital ratios, a result which is consistent to Berger et al (2009).

Insert Table 8 here

On the whole, combining all the results shown in Table 4 to 8, our findings indicate that market power in the banking industry has a positive impact on bank insolvency risk (*ZROA* and *ZROE*), risk taking (*SDROA* and *SDROE*) and total capital ratios (*CAR*). Although higher total capital ratios are expected to lower bank default risk, higher risk taking will drive default risk in the opposite direction. Therefore, our results suggest that the increase in total capital ratios in less competitive markets is not high enough to offset higher bank risk taking and to guarantee bank solvency. Alternatively, we further suggest that the self-disciplining factor gaining from higher market power is not yet sufficient to moderate excessive bank risk taking, and to increase bank incentives to hold sufficient capital ratios to ensure bank solvency.

Our findings are comparable to Agusman et al (2006) and Molyneux and Nguyen-Linh (2008) who study Asian banks, where greater market power in banking can result in higher bank risk taking and insolvency risk. On the contrary, our findings differ from Turk-Ariss (2010) who study developing countries in general, where greater bank market power enhances bank stability. These differences may be explained by different country sample used in the study.

## 6. Sensitivity analyses

In order to ensure the robustness of our results, we perform several sensitivity analyses. For brevity, the results of these sensitivity analyzes are not shown in the paper but are available from the authors on request.

First, we modify our method of estimation to quantify the degree of market power in the banking industry by changing *OPL* (the ratio of operating expenses to total loans) in the demand function, as shown in System (1), becomes the ratio of stock market capitalisation to *GDP* (*STMKTCAP*) and the inflation rate (*INF*), since both of them may influence the banking services demand. The data for *STMKTCAP* is retrieved from Beck and Demirguc-Kunt (2009). Using this specification, the result obtained in Section 5 is still well maintained. Moreover, for consistency with the majority of papers on cost efficiency/market power in the banking literature, Agoraki et al. (2009) use the Maximum Likelihood Estimation method (MLE) instead of running the SUR method used by Brissimis et al *(*2008) and Uchida and Tsutsui (2005). Hence, we also run the MLE method to System (1) instead of using the SUR method. Overall, our results regarding the impact of market power in the banking industry on individual bank risk and capital ratios remain consistent.

Second, in order to eliminate estimation biases, we also consider regressions with alternative sample. In this process, we exclude all banks with less than five years of subsequent time series observations. For the Philippines, we only exclude banks with less than three years of time series observations. Using the three years criterion may not be a potential problem, since most of Philippine banks in our sample have at least five years of observations, albeit not consecutive. Excluding banks with less than five years of subsequent time series observations would significantly reduce the number of banks in the Philippines leaving us with only one bank. Nevertheless, bank-level data in the Philippines consist of important information. The Philippines has implemented financial liberalisation and allowed a large portion of foreign ownership in restructuring its banking sector in the aftermath of the 1997 Asian crisis (Cook, 2009). Hence, the presence of foreign ownership may influence the degree of competition in the banking industry. By applying such criterion, our "new" sample consists of 317 commercial banks. For this "new" sample, we estimate the new values of market power using System (1) and the SUR method. Our results regarding the impact of a higher degree of market power are unaffected.

For accuracy, we also exclude the Philippines from our sample and only consider banks with five years of subsequent observations. Our sample shrinks to 294 banks. We again estimate the degree of bank competition by using System (1) and the SUR method. In the next

steps, we estimate Equation (2) by a GMM regression with instrumental variables. Our main results remain identical.

## 7. Conclusion

In spite of the rapid growth of consolidations in Asian banking, there is no evidence whether such consolidations enhance bank stability. For such a reason, using GMM estimations with instrumental variables, our paper attempts to investigate the link between market power in the banking industry and individual bank risk. From 607 commercial banks in 12 Asian countries over the period 2001-2007, our empirical results highlight that a higher degree of market power in the banking industry is associated with an increase in bank insolvency risk, risk taking and the total capital ratios. These results are robust to several sensitivity analyses.

In the context of Asia, market power in the banking industry might therefore exacerbate moral hazard effects encouraging banks to pursue riskier strategies, while any increase in the capital ratio is not sufficient to offset bank insolvency risk. Overall, we can conclude that in the aftermath of the 1997 Asian crisis, Asian banks still suffer from moral hazard, where the banks' self-disciplining factor gaining from less competitive market can neither moderate bank risk taking, nor provide enough incentives for banks to hold sufficient capital ratios. Finally, bank consolidations that result in higher market power in the banking industry is still problematic, and further efforts are clearly needed to combat moral hazard in Asian banks.

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**Table 1.** Descriptive statistics

| Variables | Definition | Mean | Median | Max | Min | Std. Dev. |
|---|---|---|---|---|---|---|
| *Q* | Total earning assets (million USD) | 10580572 | 717091.5 | 8.63E+08 | 40.874 | 44235815 |
| *C* | Total expenses (million USD) | 562126.1 | 56354 | 43603212 | -959907 | 2070488 |
| *d* | Total deposit and short term funding (million USD) | 9576041 | 682700 | 8.04E+08 | 7 | 39528240 |
| *R* | Total revenue (million USD) | 591999.3 | 63987.5 | 39037317 | -131340 | 2102181 |
| *w* | Total operating expenses to total assets | 0.570559 | 0.02106 | 24.7477 | 1.54E-08 | 2.334638 |
| *r* | The ratio of interest expenses to total deposits | 0.052744 | 0.029492 | 9.390108 | 8.27E-05 | 0.321224 |
| *p* | The ratio of total revenue to total earning assets | 0.085879 | 0.059908 | 26.5119 | -0.41208 | 0.46607 |
| *OPL* | The ratio of operating expenses to total loans | 0.052548 | 0.036881 | 0.326245 | 0.011159 | 0.04426 |
| *ROA* | The return on average asset | 0.00806 | 0.00865 | 0.71324 | -0.59220 | 0.03779 |
| *EQTA* | The ratio of equity to total asset | 0.08316 | 0.05479 | 0.99877 | -0.63217 | 0.10735 |
| *SDROA* | The standard deviation of *ROA* from two previous years | 0.01530 | 0.00490 | 0.73111 | 0.00003 | 0.04668 |
| *ZROA* | The Z-score based on *ROE* | 41.783 | 23.462 | 341.585 | -5.809 | 54.937 |
| *ROE* | The return on average equity | 0.08310 | 0.11021 | 9.67123 | -7.24524 | 0.44664 |
| *SDROE* | The standard deviation of *ROE* from two previous years | 0.05587 | 0.03537 | 0.69499 | 0.00000 | 0.06898 |
| *ZROE* | The Z-score based on *ROE* | 49.489 | 30.939 | 387.056 | -6.516 | 58.783 |
| *LLR* | The ratio of loan loss reserves to total loans | 0.0598 | 0.0344 | 1 | 0.001 | 0.0094 |
| *LOANG* | The annual loan growth | 0.27035 | 0.11563 | 6.97646 | -0.9650 | 0.8969 |
| *SIZE* | The logarithm of bank total asset | 13.36809 | 13.80984 | 20.65848 | 3.81507 | 3.11034 |
| *OVERHEAD* | The ratio of operating expenses to total revenue | 0.4239 | 0.3530 | 6.602 | 0.00029 | 0.3473 |
| *INFLATION* | The annual inflation rate | 0.0358 | 0.0305 | 0.2075 | -0.0395 | 0.0414 |
| *GDPG* | The annual growth rate of GDP (%) | 0.0064 | 0.0063 | 0.1140 | -0.0022 | 0.0027 |
| *RLAW* | The rule of law index from Kaufman et al (2008) | 0.038706 | 0.027478 | 0.157711 | 0 | 0.03549 |
| *ECOFREE* | The Economic Freedom index from Heritage Foundation | 60.1197 | 55.20 | 90 | 42 | 11.448 |
| *BOND* | The bond market capitalisation to GDP | 0.376524 | 0.313223 | 1.069313 | 0.132142 | 0.214013 |

**Table 2.** The Lerner index in the Asian banking industry. The Lerner index is calculated from the new industrial organisation approach following Brissimis et al (2008). A higher (lower) Lerner index is associated with an increase (decrease) in market power.

| | **Lerner Index** | | | | | |
|---|---|---|---|---|---|---|
| | China | Hong Kong | Indonesia | India | South Korea | Sri Lanka |
| 2001 | 0.570741 | 0.428638 | 0.504237 | -0.143449 | 0.395923 | 0.599729 |
| 2002 | 1.000000 | 0.900392 | 0.489753 | -0.118262 | 0.273264 | 0.741071 |
| 2003 | -0.997717 | 0.935591 | 0.60836 | -0.02357 | 0.410607 | 0.874385 |
| 2004 | 0.869957 | 0.70721 | 0.76211 | 0.000143 | 0.48544 | 0.915859 |
| 2005 | 0.822429 | 0.43478 | 0.730938 | -0.026172 | 0.492796 | 0.859094 |
| 2006 | 0.797712 | 0.285657 | 0.688297 | -0.075694 | 0.475937 | 0.813794 |
| 2007 | 0.791171 | 0.366164 | 0.75164 | -0.100164 | 0.357278 | 0.704037 |
| | **Lerner Index** | | | | | |
| | Malaysia | Philippines | Pakistan | Thailand | Taiwan | Vietnam |
| 2001 | 0.712439 | 0.513135 | 0.571413 | 0.523875 | 0.192371 | 0.152861 |
| 2002 | 0.742263 | 0.635231 | 0.534409 | 0.498261 | 0.258088 | 0.018305 |
| 2003 | 0.75319 | 0.732586 | 0.641901 | 0.566692 | 0.314807 | -0.192593 |
| 2004 | 0.766969 | 0.545519 | 0.709296 | 0.721333 | 0.393059 | -0.051874 |
| 2005 | 0.775379 | 0.619123 | 0.666741 | 0.807386 | 0.355359 | 0.135218 |
| 2006 | 0.738516 | 0.638452 | 0.604942 | 0.761431 | 0.398816 | 0.137389 |
| 2007 | 0.716482 | 0.669991 | 0.600564 | 0.724995 | 0.383869 | 0.141521 |

**Table 3.** The first-stage regression between instrumental variables and banking industry market power. The dependent variable is the degree of banking industry market power measured by the Lerner index (*LERNER*). The model is estimated using the Ordinary Least Squares method. *INF* is the inflation rate. *GDPG* is the real gross domestic product growth. *LLR* is the ratio of loan loss reserves to total loans. *LOANG* is the annual loan growth. *ROE* is the return on average equity. *EQTA* is the equity-to-total asset ratio. *OVERHEAD* is the operating expense-to-total revenue ratio. *NNI* is the ratio of non-interest income to total revenue. *SIZE* is the logarithm of total asset. Constant is included but not reported. The model is estimated by using the OLS method. The *t-statistic* values are reported in parentheses. (***) indicates significance at the 1% level, while (**) and (*) indicate significance at the 5% and 10% levels, respectively.

| | Dependent Variables : *LERNER* | | | | |
|---|---|---|---|---|---|
| Explanatory Variables | *Model 1* | *Model 2* | *Model 3* | *Model 4* | *Model 5* |
| *RLAW* | -0.2260*** | -0.1822** | -0.1831** | -0.1842** | -0.1523** |
| | (-5.295) | (-2.157) | (-2.168) | (-2.179) | (-2.171) |
| *ECOFREE* | 1.0675*** | 0.0213*** | 0.0215*** | 0.0212*** | 0.0146*** |
| | (-7.981) | (4.111) | (4.143) | (4.065) | (2.974) |
| *BOND* | 0.0172*** | 1.599*** | 1.62*** | 1.617*** | 1.251*** |
| | (-5.4508) | (10.583) | (10.68) | (10.653) | (5.262) |
| *INF* | -0.0242*** | 0.0049 | 0.005 | 0.0048 | 0.0036 |
| | (-5.616) | (1.115) | (1.131) | (1.067) | (0.7155) |
| *GDPG* | 0.0151*** | -1.558** | -1.533* | -1.511** | -1.477** |
| | (-4.305) | (-2.327) | (-2.289) | (-2.251) | (-2.095) |
| *LLR* | 0.000216 | 0.1025 | 0.1752 | 0.1808 | 0.24622 |
| | (-0.1808) | (0.6465) | (1.033) | (1.063) | (1.223) |
| *LOANG* | 0.0977*** | 0.1101*** | 0.112*** | 0.1125*** | 0.1586*** |
| | (-3.901) | (6.429) | (6.513) | (6.528) | (3.556) |
| *ROE* | | 0.0167 | 0.0156 | 0.0115 | -0.0178 |
| | | (0.6233) | (0.5817) | (0.4099) | (-0.5796) |
| *EQTA* | | | 0.1975 | 0.1991 | 0.2129 |
| | | | (1.224) | (1.234) | (0.6968) |
| *OVERHEAD* | | | | -0.0166 | 0.0313 |
| | | | | (-0.4868) | (0.7246) |
| *SIZE* | | | | | 0.0089 |
| | | | | | (1.245) |
| Number of Obsevation | 1922 | 1916 | 1914 | 1914 | 1362 |
| Adjusted R-square | 0.55 | 0.54 | 0.54 | 0.54 | 0.58 |

**Table 4.** The impact of market power in the banking industry on individual bank insolvency risk. Dependent variable is *ZROA* measured as the Z-score with the standard deviation of bank's return on average asset (*SDROA*) calculated from two previous years. *LERNER* is the market power index calculated from the new industrial organization approach following Uchida and Tsutsui (2005). *INF* is the inflation rate. *GDPG* is the real gross domestic product growth. *LLR* is the ratio of loan loss reserves to total loans. *LOANG* is the annual loan growth. *ROE* is the return on average equity. *EQTA* is the equity-to-total asset ratio. *OVERHEAD* is the operating expense-to-total revenue ratio. *NNI* is the ratio of non-interest income to total revenue. *SIZE* is the logarithm of total asset. Constant is included but not reported. The model is estimated by using the GMM method with cross-section and time fixed-effect corrections. The *t-statistic* values are reported in parentheses. (***) indicates significance at the 1% level, while (**) and (*) indicate significance at the 5% and 10% levels, respectively. Instrumental variables for *LERNER* consist of *RLAW* (rule of law), *ECOFREE* (economic freedom) and *BOND* (the ratio of bond market capitalisation to GDP).

| | Dependent Variable : *ZROA* | | | | |
|---|---|---|---|---|---|
| Explanatory Variables | *Model 1* | *Model 2* | *Model 3* | *Model 4* | *Model 5* |
| *LERNER* | -43.997** | -42.809** | -38.95** | -42.81** | -43.28* |
| | (-2.164) | (-2.156) | (-1.98) | (-2.097) | (-1.664) |
| $LERNER^2$ | 27.723 | 25.336 | 28.927 | 42.538 | -1.151 |
| | (0.4561) | (0.3927) | (0.4551) | (0.6876) | (-0.0136) |
| *INF* | 40.759 | 39.21 | 45.58 | 38.697 | 74.635 |
| | 0.5101 | (0.4806) | (0.5654) | (0.4868) | (0.7632) |
| *GDPG* | -140.914 | -147.081 | -128.25 | -85.667 | -65.13 |
| | (-0.7915) | (-0.7597) | (-0.6734) | (-0.4739) | (-0.2822) |
| *LLR* | -78.258*** | -77.993** | -27.561 | -23.196 | 0.9564 |
| | (-2.968) | (-2.537) | (-0.8809) | (-0.8121) | (0.027) |
| *LOANG* | -0.6949 | -1.071 | -0.1876 | 0.1748 | 7.202 |
| | (-0.1755) | (-0.3069) | (-0.0538) | (0.0469) | (1.298) |
| *ROE* | | 5.394 | 4.469 | 1.665 | -0.9255 |
| | | (1.185) | (0.9949) | (0.7599) | (-0.1375) |
| *EQTA* | | | 129.54*** | 125.5*** | 180.58*** |
| | | | (4.404) | (3.588) | (5.081) |
| *OVERHEAD* | | | | -10.905** | -5.057 |
| | | | | (-2.244) | (-0.6467) |
| *SIZE* | | | | | -0.6306 |
| | | | | | (-0.5007) |
| Number of Obsevation | 1860 | 1854 | 1852 | 1852 | 1321 |
| J-statistic | 14.94 | 14.52 | 15.01 | 14.45 | 4.51 |
| Adjusted R-square | 0.31 | 0.31 | 0.33 | 0.33 | 0.39 |

**Table 5.** The impact of market power in the banking industry on individual bank insolvency risk. Dependent variable is *ZROE* measured as the Z-score with the standard deviation of bank's return on average equity calculated from two previous years (*SDROE*). *LERNER* is the market power index calculated from the new industrial organization approach following Uchida and Tsutsui (2005). *INF* is the inflation rate. *GDPG* is the real gross domestic product growth. *LLR* is the ratio of loan loss reserves to total loans. *LOANG* is the annual loan growth. *ROE* is the return on average equity. *EQTA* is the equity-to-total asset ratio. *OVERHEAD* is the operating expense-to-total revenue ratio. *NNI* is the ratio of non-interest income to total revenue. *SIZE* is the logarithm of total asset. Constant is included but not reported. The model is estimated by using the GMM method with cross-section and time fixed-effect corrections. The *t-statistic* values are reported in parentheses. (***) indicates significance at the 1% level, while (**) and (*) indicate significance at the 5% and 10% levels, respectively. Instrumental variables for *LERNER* consist of *RLAW* (rule of law), *ECOFREE* (economic freedom) and *BOND* (the ratio of bond market capitalisation to GDP).

| | Dependent Variables : *ZROE* | | | | |
|---|---|---|---|---|---|
| Explanatory Variables | *Model 1* | *Model 2* | *Model 3* | *Model 4* | *Model 5* |
| *LERNER* | -77.40*** | -75.52*** | -71.741*** | -74.48*** | -66.516** |
| | (-3.195) | (-2.925) | (-2.811) | (-2.879) | (-1.982) |
| $LERNER^2$ | -17.829 | -21.47 | -16.474 | -7.003 | -96.422 |
| | (-0.2296) | (-0.2779) | (-0.2145) | (-0.0894) | (-0.8996) |
| *INF* | 61.943 | 62.105 | 66.97 | 62.718 | 142.83 |
| | (0.6223) | (0.6339) | (0.6879) | (0.6453) | (1.145) |
| *GDPG* | -438.54* | -446.58* | -413.72* | -385.082 | -404.62 |
| | (-1.873) | (-1.885) | (-1.773 | (-1.619) | (-1.374) |
| *LLR* | -36.143 | -35.085 | -12.489 | -9.631 | -4.839 |
| | (-0.9565) | (-0.9806) | (-0.3719) | (-0.2802) | (-0.1066) |
| *LOANG* | 9.557** | 8.996** | 9.029** | 9.318** | 14.548** |
| | (2.244) | (2.133) | (2.231) | (2.303) | (2.069) |
| *ROE* | | 7.272* | 6.779* | 4.475 | 2.603 |
| | | (1.898) | 1.822** | (1.171) | (0.3001) |
| *EQTA* | | | (2.016) | 56.465* | 86.52* |
| | | | | (1.881) | (1.897) |
| *OVERHEAD* | | | | -7.465 | -5.049 |
| | | | | (-1.461) | (-0.5029) |
| *SIZE* | | | | | -0.7589 |
| | | | | | (-0.4629) |
| Number of Obsevation | 1860 | 1860 | 1858 | 1858 | 1324 |
| J-statistic | 7.94 | 7.56 | 8.04 | 7.86 | 5.33 |
| Adjusted R-square | 0.13 | 0.13 | 0.15 | 0.16 | 0.13 |

**Table 6.** The impact of market power in the banking industry on individual bank risk taking. Dependent variable is *SDROA* defined as the standard deviation of bank's return on average asset calculated from two previous years. *LERNER* is the market power index calculated from the new industrial organization approach following Uchida and Tsutsui (2005). *INF* is the inflation rate. *GDPG* is the real gross domestic product growth. *LLR* is the ratio of loan loss reserves to total loans. *LOANG* is the annual loan growth. *ROE* is the return on average equity. *EQTA* is the equity-to-total asset ratio. *OVERHEAD* is the operating expense-to-total revenue ratio. *NNI* is the ratio of non-interest income to total revenue. *SIZE* is the logarithm of total asset. Constant is included but not reported. The model is estimated by using the GMM method with cross-section and time fixed-effect corrections. The *t-statistic* values are reported in parentheses. (***) indicates significance at the 1% level, while (**) and (*) indicate significance at the 5% and 10% levels, respectively. Instrumental variables for *LERNER* consist of *RLAW* (rule of law), *ECOFREE* (economic freedom) and *BOND* (the ratio of bond market capitalisation to GDP).

| | Dependent Variables : *SDROA* | | | | |
|---|---|---|---|---|---|
| Explanatory Variables | *Model 1* | *Model 2* | *Model 3* | *Model 4* | *Model 5* |
| *LERNER* | 0.0258*** | 0.0257*** | 0.0248*** | 0.0252*** | 0.0324*** |
| | (3.999) | (3.988) | (3.849) | (3.844) | (2.978) |
| $LERNER^2$ | -0.0164 | -0.0175 | -0.0179 | -0.0192 | 0.0149 |
| | (-0.7577) | (-0.8083) | (-0.8353) | (-0.8796) | (0.4163) |
| *INF* | 0.0305 | 0.0294 | 0.0295 | 0.03089 | 0.0476 |
| | (1.146) | (1.107) | (1.122) | (1.175) | (1.1758) |
| *GDPG* | 0.1994*** | 0.1971*** | 0.1928*** | 0.1883*** | 0.2885*** |
| | (3.107) | (3.07) | (3.042) | (2.926) | (2.967) |
| *LLR* | -0.0326*** | -0.0332*** | -0.0419*** | -0.0427*** | -0.0557*** |
| | (-3.209) | (-3.278) | (-4.091) | (-4.117) | (-3.766) |
| *LOANG* | -0.0034*** | -0.0032*** | -0.0033*** | -0.0034*** | -0.008*** |
| | (-3.032) | (-2.904) | (-3.02) | (-3.06) | (-3.449) |
| *ROE* | | -0.0018 | -0.0017 | -0.0013 | -0.0034 |
| | | (-1.231) | (-1.136) | (-0.8207) | (-1.196) |
| *EQTA* | | | -0.0235*** | -0.0236*** | -0.0337** |
| | | | (-2.601) | (-2.609) | (-2.281) |
| *OVERHEAD* | | | | 0.0016 | -0.0066** |
| | | | | (0.8189) | (-2.034) |
| *SIZE* | | | | | -0.0011** |
| | | | | | (-2.129) |
| Number of Obsevation | 1911 | 1905 | 1903 | 1903 | 1352 |
| J-statistic | 23.12 | 23.85 | 24.29 | 24.62 | 7.07 |
| Adjusted R-square | 0.35 | 0.33 | 0.34 | 0.34 | 0.16 |

**Table 7.** The impact of market power in the banking industry on individual bank risk taking. Dependent variable is *SDROE* defined as the standard deviation of bank's return on average equity calculated from two previous years. *LERNER* is the market power index calculated from the new industrial organization approach following Uchida and Tsutsui (2005). *INF* is the inflation rate. *GDPG* is the real gross domestic product growth. *LLR* is the ratio of loan loss reserves to total loans. *LOANG* is the annual loan growth. *ROE* is the return on average equity. *EQTA* is the equity-to-total asset ratio. *OVERHEAD* is the operating expense-to-total revenue ratio. *NNI* is the ratio of non-interest income to total revenue. *SIZE* is the logarithm of total asset. Constant is included but not reported. The model is estimated by using the GMM method with cross-section and time fixed-effect corrections. The *t-statistic* values are reported in parentheses. (***) indicates significance at the 1% level, while (**) and (*) indicate significance at the 5% and 10% levels, respectively. Instrumental variables for *LERNER* consist of *RLAW* (rule of law), *ECOFREE* (economic freedom) and *BOND* (the ratio of bond market capitalisation to GDP).

| | Dependent Variables : *SDROE* | | | | |
|---|---|---|---|---|---|
| Explanatory Variables | *Model 1* | *Model 2* | *Model 3* | *Model 4* | *Model 5* |
| *LERNER* | 0.5382*** | 0.5047*** | 0.4965*** | 0.3764*** | 0.4557*** |
| | (4.518) | (4.326) | (4.243) | (3.215) | (3.20) |
| $LERNER^2$ | -0.4026 | -0.3755 | -0.3785 | -0.402 | -0.7045 |
| | (-1.009) | (-0.9622) | (-0.9739) | (-0.9512) | (-1.428) |
| *INF* | -0.3753 | -0.4139 | -0.4129 | -0.1560 | -0.4069 |
| | (-0.7624) | (-0.8601) | (-0.8598) | (-0.3369) | (-0.7125) |
| *GDPG* | 2.517*** | 2.566** | 2.532** | 1.887 | 1.379 |
| | (2.123) | (2.214) | (2.198) | (1.633) | (0.8499) |
| *LLR* | -0.3021 | -0.3464* | -0.4189** | -0.612*** | -0.5002* |
| | (-1.609) | (-1.893) | (-2.25) | (-3.586) | (-1.797) |
| *LOANG* | -0.0659*** | -0.0508** | -0.0517** | -0.059** | -0.0457 |
| | (-3.215) | (-2.529) | (-2.574) | (-2.336) | (-1.051) |
| *ROE* | | -0.1955*** | -0.1939*** | -0.1977*** | -0.1581** |
| | | (-6.642) | (-6.612) | (-6.390) | (-2.269) |
| *EQTA* | | | -0.1969 | -0.3644** | -0.1446 |
| | | | (-1.197) | (-2.095) | (-0.5745) |
| *OVERHEAD* | | | | -0.0129 | 0.0243 |
| | | | | (-0.6469) | (0.5125) |
| *SIZE* | | | | | -0.0051 |
| | | | | | (-0.6636) |
| Number of Obsevation | 1905 | 1902 | 1900 | 1900 | 1351 |
| J-statistic | 11.22 | 14.08 | 14.87 | 15.08 | 9.32 |
| Adjusted R-square | 0.34 | 0.37 | 0.37 | 0.37 | 0.53 |

**Table 8.** The impact of market power in the banking industry on individual bank capital ratios. Dependent variable is *CAR* defined as the ratio of total capital ratio to risk-weighted asset. *LERNER* is the market power index calculated from the new industrial organization approach following Uchida and Tsutsui (2005). *INF* is the inflation rate. *GDPG* is the real gross domestic product growth. *LLR* is the ratio of loan loss reserves to total loans. *LOANG* is the annual loan growth. *ROE* is the return on average equity. *EQTA* is the equity-to-total asset ratio. *OVERHEAD* is the operating expense-to-total revenue ratio. *NNI* is the ratio of non-interest income to total revenue. *SIZE* is the logarithm of total asset. Constant is included but not reported. The model is estimated by using the GMM method with cross-section and time fixed-effect corrections. The *t-statistic* values are reported in parentheses. (***) indicates significance at the 1% level, while (**) and (*) indicate significance at the 5% and 10% levels, respectively. Instrumental variables for *LERNER* consist of *RLAW* (rule of law), *ECOFREE* (economic freedom) and *BOND* (the ratio of bond market capitalisation to GDP).

| | Dependent Variables : *CAR* | | | | |
|---|---|---|---|---|---|
| Explanatory Variables | *Model 1* | *Model 2* | *Model 3* | *Model 4* | *Model 5* |
| *LERNER* | 0.0568** | 0.0604** | 0.0954** | 0.0931*** | 0.1728*** |
| | (2.111) | (2.252) | (4.048) | (3.888) | (4.241) |
| $LERNER^2$ | -0.0621 | -0.0679 | -0.1189 | -0.1114 | -0.1299 |
| | (-0.7949) | (-0.869) | (-1.723) | (-1.539) | (-1.435) |
| *INF* | 0.0683 | 0.0669 | -0.029 | -0.033 | 0.0398 |
| | (0.62) | (0.6084) | (-0.3087) | (-0.3401) | (0.3098) |
| *GDPG* | -0.1947 | -0.2029 | -0.2087 | -0.1839 | -0.1162 |
| | (-0.8224) | (-0.8586) | (-1.005) | (-0.8477) | (-0.4514) |
| *LLR* | 0.0849 | 0.1097* | 0.4391*** | 0.4438*** | 0.2946*** |
| | (1.387) | (1.79) | (7.791) | (7.781) | (3.787) |
| *LOANG* | -0.042*** | -0.0429*** | -0.0324*** | -0.0324*** | -0.0339*** |
| | (-8.205) | (-8.488) | (-7.186) | (-7.174) | (-4.083) |
| *ROE* | | 0.0233*** | 0.0183*** | 0.0158** | 0.013 |
| | | (3.192) | (2.853) | (2.138) | (1.299) |
| *EQTA* | | | 0.9667*** | 0.9672*** | 0.9134*** |
| | | | (19.377) | (19.379) | (13.769) |
| *OVERHEAD* | | | | -0.0072 | -0.0108 |
| | | | | (-0.7536) | (-0.9128) |
| *SIZE* | | | | | -0.0012 |
| | | | | | (-0.7012) |
| Number of Obsevation | 1566 | 1566 | 1565 | 1565 | 1149 |
| J-statistic | 3.36 | 4.1 | 5.47 | 5.88 | 1.55 |
| Adjusted R-square | 0.8 | 0.8 | 0.85 | 0.85 | 0.79 |