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Full Length Research Paper

Do supervisory mechanisms or market discipline relate to bank capital requirements and risk-taking adjustment? International evidence

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This study proposed a modified method to investigate whether capital regulations have an effect on bank risk-taking, or whether their effects are channeled through supervisory mechanisms and market discipline. This study used data from 1,702 banks of 42 countries over the period 2000 to 2007 to verify the capital buffer theory (Marcus, 1984; Milne and Whalley, 2001). It was found that the empirical results supported the hypotheses proposed in this paper: (1) Banks with high capital buffer positions will adjust their capital adequacy ratio and risk-taking in the same direction; (2) Banks with low capital buffer positions will adjust their capital faster than banks with high capital buffers. The empirical results suggested that banks with stringent supervisory mechanisms tend to mitigate adjustments of the capital buffer, but take on higher credit risk-adjustments. However, the impact of market discipline was in the opposite direction. The results clearly suggested that regulations alone may not be adequate to control credit risk-taking and that thorough investigation of supervisory mechanisms and market discipline are also required. Furthermore, it appeared that ignoring the interactions between regulations and adjustment of capital and risk could lead to erroneous inferences about the impact of regulations on credit risk-taking. The results implied that incentives and tools that enhance market power self-monitoring could promote reductions in risk-taking. This paper attempted to provide some insights in the wake of the global financial tsunami.

Key words: Supervisory mechanism, market discipline, credit risk-taking, capital buffer, regulation.

INTRODUCTION

The Basel I accord released in 1988 and the Basel II accord released in 2006 specified that the banking industry must provide a proper capital adequacy ratio and fulfill risk management for credit, market and operational risk. Capital regulation for banks aims to discipline banks and promote financial stability. The Great Depression in 1929, the savings and loan crisis in 1980's, the Swedish financial crisis from 1992 to 1993, the Japanese financial crisis in 1990's and the 2008 American subprime mortgage crisis resulted in a global financial tsunami. The financial storms initiated by these events influenced many countries, as well as global economic development. Therefore, how to effectively standardize banks' risk-taking behavior is an important issue.

Economic theories are unclear on whether imposing harsher capital requirements will lead banks to increase risk-taking in their asset portfolio. Furthermore, the question of whether capital adequacy rules limit incentives for banks to engage in morally hazardous behavior has remained unsolved for more than 20 years (Liebwein, 2006; Von Bomhard and Frey, 2006; Karp, 2007; Holzmüller, 2009). In recent years, a number of empirical studies have examined the impact of regulatory capital standards on risk-taking behavior. These studies

JEL classification*:* G21; G32; G38.

also investigated the ability of capital standards to successfully eliminate this moral hazard problem. As more is learned about the dynamics of financial stability, the interrelated characteristics of regulation, competition and risk-taking in the banking sector have received increased attention from scholars and policy makers (Keeley, 1990; Thornton, 1992). However, researchers have not examined empirically whether and how regulations interact with supervisory mechanisms or market discipline in shaping the risk-taking behavior of individual banks.

The establishment of capital requirements was intended to force banks to provide adequate capital reserves to cope with probable losses in the future. Therefore, when risk-taking increases, the capital requirements compel the bank to provide more equity capital. On the contrary, when the bank's equity capital is too low, the capital requirements will restrict the bank from bearing excessive risk. However, the capital requirements do not guarantee that the bank will not have a moral hazard, even if the pressure of the capital requirements on the bank will result in a negative effect. Although it has been two decades since the release of Basel I, the issues of risk-taking are not well documented. For example, was the 1988 agreement effective in raising capital ratios among banking institutions that fell below the minimum requirements? How did banks respond to the capital adequacy rules? Do banks adjust their capital adequacy ratio and risk-taking behavior, and how do these adjustments influence each other under different supervisory mechanisms or market discipline? Finally, do banks behave differently under different institutional settings? The lack of answers to these questions is largely due to the limited amount of data on capital adequacy levels and risky assets of banks in most countries.

Previous research has seldom provided long-term multinational evidence on how banks adjusted their capital and risks in answer to the capital requirements, and most studies in the literature have focused mainly on the US market (Jacques and Nigro, 1997; Aggarwal and Jacques, 1998, 2001) or other unique markets (Hall, 1990; Hall, 1997; Ediz et al., 1998; Rime, 2001; Heid et al., 2004; Staikouras, 2005; Godlewski, 2007; Holzmüller, 2009). Empirical studies on emerging country studies are insufficient. Furthermore, there is only limited evidence that cross country comparisons are related to capital regulation and credit risk under different country regulations. Consequently, investigate whether capital regulations have an effect on bank risk-taking, or whether their effects are channeled through supervisory mechanisms and market discipline is an important academic issue and has implications for supervisory behavior.

The main contribution of this study is to add an extension to the empirical literature. Therefore, this study proposed a simultaneous equation model to explore the effects of the 1998 Basel accord revision on bank risk-taking behavior under different supervisory mechanisms and market discipline, to provide insights in the period after the global financial tsunami. This study extended the simultaneous equation model developed by Shrieves and Dahl (1992) to a multi-country setting, to analyze the relationship between changes in the capital adequacy ratio and credit risk-taking from 1,702 banks of 42 countries over the period 2000 to 2007. The model also analyzed the behavior of under-capitalized banks towards capital adequacy ratios and credit risk, so as to validate the differences of the moral hazard theory (Shrieves and Dahl, 1992) and the capital buffer theory (Marcus, 1984; Milne and Whalley, 2001) among countries under different supervisory mechanisms and market discipline.

Literature review and hypotheses

Research on traditional moral hazards have focused on the rigidities and adjustment costs, and have therefore proposed that banks will not hold capital higher than the minimum capital adequacy ratio. However, banks will not adjust their capital or risk-taking behavior immediately only for the adjustment cost or market without liquidity (Heid et al., 2004). In addition, under information asymmetry, the action of raising capital will be regarded as negative information for the bank's shareholders (Myers and Majluf, 1984). This action shows that banks are unable or unwilling to make immediate responses to negative capital impacts. In another view, the violation of standards causes supervisory action at a very high cost, even to the point of closing the bank, so the bank has the motive to hold more capital buffer than required, as insurance against violating the minimum capital adequacy ratio. This motive will increase with the probability of the capital adequacy ratio violating the standard. Increasing the capital will consume more costs than increasing the insured deposits and such a trade-off can determine the optimal capital (Marcus, 1984; Milne and Whalley, 2001).

The moral hazard and capital buffer theories have different implications of how banks adjust their capital and risk-taking behavior according to the minimum capital adequacy ratio. The moral hazard theory suggests that when the capital adequacy ratio forces banks to increase their capital, their risks will also increase. Shrieves and Dahl (1992), Jacques and Nigro (1997), Aggarwal and Jacques (2001), and Rime (2001) found that capital is positively correlated with risk-taking behavior, meaning that banks face risks with an increase in capital. These studies support the view of the moral hazard theory. In contrast, the capital buffer theory suggests that banks have a strong motive to follow capital requirements, and will hold the capital buffer higher than the minimum capital adequacy ratio. Such a preparation can be regarded as a type of buffer mechanism that safeguards the banks from failing to meet capital requirements. The banks will then determine the risk-taking behavior according to the size of the capital buffer. More specifically, a bank with a high capital buffer will increase the risk while increasing the capital in order to maintain its capital buffer and maintain its capital at a safe level. At that time, capital and risk become positively correlated. On the contrary, a bank with a low capital buffer will reduce risk while increasing capital in order to reconstruct a proper capital buffer to reach a safe level. The capital and risk then become negatively correlated (Heid et al., 2004).

Jeitschko and Jeung (2005) used the unified approach to integrate the individual motives of deposit insurance companies, shareholders and management echelon to discuss the relationship between the bank's capitalization and risk-taking behavior. The results showed how the degree of capitalization influencing the bank's risk depends on the bargaining power of the three parties. In addition, in a multinational empirical study, Godlewski (2004) investigated 30 emerging market countries, and included norms, systems and laws to discuss how banks react according to capital requirements. Matejašák and Teplý (2007) validated the model by comparing banks from the US and 15 EU countries, and making different settings based on regulatory pressure variables. They found that the banks all would increase their capital under the requirement of the minimum capital adequacy ratio, and the US banks would reduce their portfolio risks at the same time.

Mline and Whally (2002) and Heid et al. (2004) proposed the capital buffer theory, suggesting that a bank will hold capital higher than the minimum capital requirement, as a buffer position. When the bank's capital buffer is high, it will be more powerful than other banks to cope with losses resulting from the increase in risks, and will be less likely to have an insufficient capital adequacy ratio.

Capital buffer theory classifies banks into two types according to the level of capital buffer, and there are different behavior models for the adjustment of capital and risk. First, banks with a high capital buffer tend to maintain the buffer position. This type of bank is only concerned about whether the capital buffer is sufficient to cope with the risk loss, namely, a capital and risk increase at the same time, or a decrease at the same time. A low level of regulatory pressure will result in a slow adjusting speed by the bank. On the other hand, banks with a low level of capital buffer will reconstruct their buffer position. This type of bank will raise the capital buffer actively in order to relieve the pressure of capital requirements. Capital increases and risk reduction can occur at the same time, indicating that the bank is seizing the opportunity to be promoted to a bank with a high capital buffer. On the contrary, risk increases and capital decreases can occur at the same, indicating that the bank is exchanging high risk for high return to regain its stand. Moreover, a large regulatory pressure will accelerate the bank's adjusting speed.

In order to verify the capital buffer theory, this study referred to Heid et al. (2004), and added the dummy variable of regulatory pressure in the regression equation to examine the following hypotheses:

H_1^1: Banks with high capital buffer positions will adjust their capital ratio and risk-taking in the same direction. When at least one of the two coefficients (α_2, β_3) in Equations 1 to 2 is positive $(\alpha_2 > 0)$ or $(\beta_3 > 0)$, then the capital buffer theory is met.

H_1^2: Banks with low capital buffer positions will adjust their capital ratio and risk-taking in opposite directions. When at least one set of the two sets of coefficient sums is negative $(\alpha_2 + \alpha_6) < 0$ or $(\beta_3 + \beta_6) < 0$ in Equation 1 and 2, the capital buffer theory is met.

H_1^3: Banks with low capital buffer positions will adjust their capital faster than banks with high capital buffer; that is, $\alpha_7 < 0$ or $\beta_7 < 0$ in Equation (1) to (2).

METHODOLOGY AND DATA

Model specification

To acknowledge that capital and risk-taking decisions are determined together, this paper applied the simultaneous equation model used in Shrieves and Dahl (1992) to a multi-country setting. Hart and Jaffee (1974) and Marcus (1984) indicated that changes in bank capital and risk are influenced by the bank's internal behavior, as well as the effect of exogenous influences, including unexpected profit changes in the capital aspect. According to the structure of the above studies' adjustment action (Hart and Jaffee, 1974; Marcus, 1984; Shrieves and Dahl, 1992; Van Roy, 2005), banks cannot adjust capital and risk completely and synchronously, but carry out partial increases and decreases each time to make the capital and risk approach the target level. As capital and risk adjustments influence each other, the model design in this paper was based on the structure of partial adjustments. The following simultaneous equations were proposed to examine how banks make adjustments according to the capital requirements channeled through the supervisory mechanisms and market discipline:

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \sum_{j=1}^{4} \gamma_{jt}(X_{jt}) + \sum_{j=1}^{3} \lambda_{jt}(Y_{jt}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (1)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \sum_{j=1}^{4} \gamma_{jt}(X_{jt}) + \sum_{j=1}^{3} \lambda_{jt}(Y_{jt}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (2)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_1 (X_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (3)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH + \gamma_1 (X_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (4)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_2 (X_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (5)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \gamma_2 (X_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (6)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_3 (X_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (7)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \gamma_3 (X_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (8)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_4 (X_{4t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (9)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \gamma_4 (X_{4t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (10)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \lambda_1 (Y_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (11)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH + \lambda_1 (Y_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (12)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \lambda_2 (Y_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (13)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \lambda_2 (Y_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (14)$$

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \lambda_3 (Y_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (15)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \lambda_3 (Y_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (16)$$

In the above specifications, bank capital adjustment ($dCAR$) and risk-taking adjustment ($dRISK$) of bank *i* at research period *t* ($t = 2000 \sim 2007$) is written as a function of time-dependent indices of bank regulation, REG; bank-level variables ($SIZE, ROA, LLOSS$) reflecting the characteristics of each bank; X vector variable reflects the supervisory mechanisms, which included $BFREE2, KK\_COMPO, SUPERVIS, SLRINDEX$; Y vector variable reflects the market discipline, which included $CONCEN, MCCPG, DCPBSPG$. Furthermore, the dummy variables for each year are noted as YR; macroeconomic conditions common to all banks, $GROWTH$ and $\varepsilon_{i,t}$ and $v_{i,t}$ are the disturbance terms of white noise and are independent of each other.

In the empirical evidence, this paper divided the model into three sets of simultaneous equations for analysis. There was no interaction item in the first set of simultaneous equations, and only the influence of specific variables of various banks or macroeconomic variables on the banks was discussed, as well as the adjustments between the overall capital and risks. The interaction item of regulatory pressure and pre-capital or risk-taking level ($REG_{i,t}*CAR_{i,t-1}$ and $REG_{i,t}*RISK_{i,t-1}$) was added in the second set of simultaneous equations to check whether capital buffer would influence the speed of the bank adjusting its capital buffer. Finally, the interaction item of regulatory pressure and the change value of capital or risk-taking ($REG_t*dRISK_{i,t}$ and $REG_t*dCAR_{i,t}$) were added in the third set of simultaneous equations to observe how to adjust the capital level and risk-taking under different levels of capital buffers.

From Equations 1 and 2, a positive and significant coefficient for $dCAR_{i,t}$ and $dRISK_{i,t}$ would indicate that banks increased their capital to assets ratio and their credit risk-taking simultaneously, which is a result consistent with the unintended effects of more stringent capital requirements, while a negative and significant coefficient would indicate that higher capital to assets ratios give banks greater incentives to decrease credit risk-taking.

Definitions of variables

Definitions of capital and risk

Capital level (CAR): This paper used the "leverage ratio" used by Shrieves and Dahl (1992) to measure the capital level, and divided the total capital by total assets, where the total capital is the core capital plus supplementary capital. The computing formula refers to the definition of capital specified in Basel I (1988).

$$\text{CAR} = \frac{\text{Total Capital}}{\text{Total Assets}} \quad (17)$$

Credit risk-taking (RISK): Jacques and Nigro (1997) indicated that bank loans have been brought into the calculation of risk-weighted assets, and loans with different attributes have different risk weights, so the influence of the loan quality on bank risk could be obtained from the ratio of risk-weighted assets to total assets. Avery and Berger (1991) and Berger (1995) also proved that this ratio has a significantly positive relationship with bank risk. Therefore, this paper used "risk-weighted assets divided by total assets" to measure the bank's credit risk-taking behavior.

$$\text{RISK} = \frac{\text{RWA}}{\text{Total Assets}} \quad (18)$$

Bank specific variables

Size (SIZE): Shrieves and Dahl (1992), Rime (2001), and Aggrawal and Jacques (1998) indicated that large banks have easier access to funds from external capital markets, therefore, in addition to their own capital buffer position, large banks have a larger available amount of funds than small banks, and are expected to have lower capital to assets ratios than smaller banks. Van Roy (2003) proposed that large banks have a large reinvestment opportunity and business scope, which should increase their ability to diversify their portfolios and decrease their risk-taking behavior. Therefore, bank size is defined as a natural logarithm from total assets. The expected results of this variable are negative.

$$\text{SIZE} = \log(\text{Total Assets}) \quad (19)$$

Profitability (ROA): Rime (2001) and Van Roy (2005) suggested that profitability should have a significantly positive relationship with the bank's adjustment, because under information asymmetry, external financing would create the "message emission effect". Banks tend to give priority to using retained earnings as a main source of incremental capital when increasing the capital adequacy ratio to satisfy capital requirements. Banks with high profitability are likely to increase their capital level. Therefore, this paper adopted ROA to measure the profitability. ROA is defined as net income after tax divided by average total assets. The coefficient of ROA is expected to present a significantly positive sign in Equation 1.

$$\text{ROA} = \frac{\text{Net Income after Tax}}{\text{Average Total Assets}} \quad (20)$$

Loan loss provisions ratio (LLOSS)

Aggarwal and Jacques (1998), and Van Roy (2005) indicated that the deterioration of asset quality prevents banks from assuming higher risks. However, Matejašák and Teplý (2007) argued that an increase in loan loss provisions is a cause for the rise of bank risk-taking. Therefore, in this paper, the loan loss provisions were divided by total assets to measure the bad debt ratio. Banks provide the loan loss provisions to cope with losses from loans that cannot be recovered, and the loans of most banks account for a large proportion of assets. Therefore, this variable could reflect the bank's asset quality. The loan loss provisions ratio was added in Equation (2) and a significantly negative coefficient was expected.

$$\text{LLOSS} = \frac{\text{Loan Loss Provisions}}{\text{Total Assets}} \quad (21)$$

Regulatory pressure (REG): Aggarwal and Jacques (1997) defined the regulatory pressure variable based on prompt corrective action, and suggested that it will occur only when the capital adequacy ratio is lower than the minimum capital requirement. In addition, Ediz, et al. (1998) and Rime (2001) proposed that regulatory pressure will occur when the bank's capital adequacy ratio decreases to somewhere before the minimum capital requirement. Heid et al. (2004) suggested using the structure of a standardized capital buffer position as the criterion for selecting the threshold. Heid et al. (2004) proposed that in the selection of the threshold, it is feasible to take the median or first quartile after obtaining the bank's standardized capital buffer position.

This paper adopted the structure of standardized capital buffer position, namely, the regulatory pressure was set as a dummy variable, and the first quartile of the standardized capital buffer position was used as the threshold of the regulatory pressure dummy variable. When the capital ratio (CAR) was less than or equal to the threshold (THR), the dummy variable of regulatory pressure was set as 1, otherwise as 0.

$$\text{REG} = \begin{cases} 1\text{......if CAR} \le \text{THR} \\ 0\text{......otherwise} \end{cases} \quad (22)$$

Country level variables

Economic growth (GROWTH): Van Roy (2005) included the economic growth rate in the cross-country comparison to distinguish macroeconomic impacts in different countries. Since banks are an important part of the financial industry that is likely to be influenced by the business cycle, if a country meets with a financial crisis, the bank's business amount and structure must be changed greatly. Therefore, this paper used the real GDP growth rate to measure the economic growth rate.

$$\text{GROWTH} = \left(\frac{\text{REAL GDP}_{\text{obs. year}}}{\text{REAL GDP}_{\text{base year}}} - 1\right) \quad (23)$$

Supervisory mechanism: In order to explore the possible effects of changes in the supervisory mechanism on the banks' adjustments of capital adequacy ratio and risk-taking behavior, the variables of the supervisory mechanism considered were as follows:

1. Indicator of the relative openness of banking and financial system ($BFREE2$): Specifically, whether foreign banks and financial service firms are able to operate freely, how difficult it is to open domestic banks and other financial services firms, how heavily regulated the financial system is, the presence of state-owned banks, whether the government influences the allocation of credit, and whether banks are free to provide customers with insurance and invest in securities (and vice-versa). The index ranges in value from 1 (very low: Many restrictions) to 5 (very high: Few restrictions). The index was averaged during the period 1995 to 1997.

2. Composite of six governance indicators (KK_COMPO): voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and corruption. Individual factors are weighted equally to determine the overall score of economic freedom. Higher values correspond to better governance outcomes.

3. Principal component indicator of 14 dummy variables ($SUPERVIS$): (a) Does the supervisory agency have the right to meet with external auditors to discuss its report without the approval of the bank? (b) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? (c) Can supervisors take legal action against external auditors for negligence? (d) Can the supervisory authority force a

Table 1. Samples.

U.S. (321)	Austria(42)	Belgium(16)	Brazil (62)	Hungary(17)	Mexico(18)
Luxembourg (60)	Canada (22)	Denmark (36)	Turkey (10)	South Africa (1)	Taiwan (35)
Finland (2)	France (118)	Germany (137)	Argentina (11)	Chile (30)	China (32)
Greece (1)	Britain (47)	Ireland (10)	Colombia (2)	Czech (16)	Egypt (20)
Israel (18)	Spain (1	Japan (232)	India (51)	Indonesia (32)	Malaysia (30)
Holland (14)	Sweden (4)	Norway (2)	Morocco (9)	Pakistan (21)	Peru (9)
Portugal (1)	Switzerland (125)	South Korea (19)	Philippines(2)	Russia (45)	Thailand (21)

Figures in brackets indicate the number of bank.

bank to change its internal organizational structure? (e) Are off-balance sheet items disclosed to supervisors? (f) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (g) Can the supervisory agency suspend the directors' decision to distribute dividends, bonuses or management fees? (h) Can the supervisory agency legally declare that a bank is insolvent? (i) Does the banking law give authority to the supervisory agency to intervene and suspend some or all ownership rights of a problem bank? (j) Can the supervisory agency or any other government agency supersede shareholder rights, remove and replace management, or remove and replace directors?

4. Strength of legal rights index ($SLRINDEX$): To measure the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 to 10, with higher scores indicating that these laws are better designed to expand access to credit.

Market discipline:

1. Asset concentration ($CONCEN$): Assets of the three largest banks as a share of the assets of all commercial banks.

2. Market capitalization ($MCCPG$): Market capitalization (also known as market value) is the share price multiplied by the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. Listed companies do not include investment companies, mutual funds, or other collective investment vehicles.

3. Domestic credit provided by the banking sector ($DCPBSPG$): Including all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan institutions and building and loan associations.

Subject, period and data source

BankScope and Compustat provided data from balance sheets and income statements in thousands of US dollars. The samples of the supervisory mechanism indicators were derived from The World Bank, asset concentration data were obtained from Fitch's BankScope database, and market capitalization data were derived from standard and poor's emerging stock markets Factbook and supplemental S&P data, as well as World Bank and OECD GDP (organisation for economic co-operation and development gross domestic product) estimates. Domestic credit data of the banking sector, including all credit to various sectors on a gross basis, were based on the International Monetary Fund, International Financial Statistics and data files, as well as World Bank and OECD GDP estimates.

Furthermore, to get a relatively homogenous sample of banks, this study bounded the variables at 0.01%. This study also dropped the missing values for banks that did not report their total capital ratio. The tier 1 ratio or financial ratio for at least two consecutive years was deleted from the data set for these banks. This study constructed a pooled data set containing 42 countries, based on the country classification of Britain's FTSE in 2009. Hsiao (1985) pointed out that a panel data set offers a certain number of advantages over a traditional cross section or pure time-series data set. The number of effective bank samples shown in Table 1 was 1,702 commercial banks.

Statistical method

As the ordinary least square method (OLS) has endogenous problems between changes in capital and risk, the estimated coefficient may have biased errors. Zellner (1962) indicated that the three-stage least square method (3SLS) allows the covariance between disturbance terms to be non-zero. The two-stage least square method (2SLS) neglects the information derived from the correlation between disturbance terms, therefore 3SLS is more efficient than 2SLS. In addition, although 3SLS considers more complete information and cross equation correlations, and obtains a more accurate estimated value; Intrilligator (1978) indicated that 3SLS may be more sensitive to misspecification and measurement errors. The adjustments of capital and risk-taking behavior are seldom carried out at the same time, and there is endogenesis between changes in capital and risk. Therefore, this paper used 2SLS and 3SLS respectively to examine the banks' adjustment behavior in capital and risk and to promote robustness.

EMPIRICAL RESULTS

Descriptive statistical analysis

According to Table 2, the mean of the capital adequacy ratio (CAR) for all countries was 13.72%, their standard deviation of the capital adequacy ratio (CAR) was 13.09%. The mean of the risk-weighted asset ratio ($RISK$) for all countries was 78.12%, their standard deviation of the risk-weighted asset ratio ($RISK$) was 21.04%. The mean of the capital adequacy ratio changes ($dCAR$) for all countries was -0.04%, meaning the banks mostly

Table 2. Descriptive statistics.

Variable	Observations	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
CAR	13330	0.1372	0.0977	4.7407	-0.4630	0.1309	6.2966	131.0041
dCAR	13330	-0.0004	0.0000	3.7596	-3.7407	0.0681	-0.5026	1403.7900
RISK	13330	0.7812	0.8397	4.7111	0.0094	0.2104	-0.3375	12.2662
dRISK	13330	0.0004	0.0000	3.7413	-4.5006	0.0847	-4.6260	891.4824
SIZE	13330	14.7153	14.6751	21.7407	7.2661	2.0390	0.1592	2.8649
ROA	13330	1.6894	0.8000	105.0000	-321.0000	7.0134	-9.5194	425.1976
LLOSS	13330	0.0045	0.0022	0.6074	-1.7925	0.0195	-56.8964	5547.2740
REG	13330	0.4403	0.0000	1.0000	0.0000	0.4964	0.2406	1.0579
GROWTH	13330	3.2220	2.6730	13.0300	-10.8950	2.3746	0.9068	5.6058
BFREE2	13330	3.5591	3.3333	5.0000	2.0000	1.0715	0.0216	1.7206
KK_COMPO	13330	1.0186	1.2567	1.9567	-1.0633	0.7609	-1.1166	3.0373
CONCEN	13330	0.3802	0.3246	0.8760	0.1249	0.1687	1.3280	4.0241
SUPERVIS	13330	6.0278	6.0000	11.0000	0.0000	1.6917	-1.4603	7.2562
SLRINDEX	13330	6.2900	7.0000	10.0000	3.0000	1.9208	-0.3488	1.9105
MCCPG	13330	90.1274	87.6594	333.3076	6.8372	46.2161	0.6470	4.9336
DCPBSPG	13330	154.5347	132.5918	312.7838	15.0158	82.2537	0.4628	2.2231

decreased their capital for adjustment. The standard deviation of the capital adequacy ratio changes ($dCAR$) for all countries was 6.81%. The mean value of the changes of the risk-weighted asset ratio ($dRISK$) for all countries was 0.04%, and the risk-taking of banks increased by approximately the same amount. The standard deviation of the risk-weighted asset ratio changes ($dRISK$) for all countries was 8.47%.

As for the other control variables, the mean ROA for all countries was 168.94%. The standard deviation for all countries was 701.34%. On the side of four supervisory mechanism indicators, the mean $BFREE2$ for all countries was 3.5591, the indicator of relative openness of the banking and financial system is generally high. The mean KK_COMPO for all countries was 1.0186. Furthermore, the mean $SUPERVIS$ for all countries was 6.0278. Finally, the mean $SLRINDEX$ for all countries was 6.2900. As for the three market discipline indexes, the mean $CONCEN$ for all countries was 0.3802 Furthermore, the mean $MCCPG$ for all countries was 90.1274. Finally, the mean $DCPBSPG$ for all countries was 154.5347.

Interaction between capital adequacy changes and risk-taking changes

This paper represented the regression equation of risk-taking change to the change of capital adequacy using a capital equation that is, using the change of capital adequacy ratio as the dependent variable, and using the risk-taking change as the independent variable), and represented the regression equation of capital adequacy change to risk-taking change using a risk equation (that is, using the risk-taking change as the dependent variable, and using the change of capital adequacy ratio as the independent variable). Three sets of simultaneous equations were divided in the model design, so as to explore the effects of regulatory pressure, supervisory mechanisms and market discipline on banks, to examine whether the banks conform to the capital buffer theory.

Table 3 shows the correlation between capital adequacy adjustments and risk-taking adjustments, given the condition that all samples meet the capital requirements. This paper expected that regulatory pressure (REG) would prompt banks to increase the capital adequacy ratio or decrease risk-taking. In Panel A (capital equation) of Table 3, this study found a positive and significant association between regulatory pressure and changes of the capital adequacy ratio, but adverse results were obtained from Model I in Panel A. It could be due to the complicated influence of regulatory pressure on banks. It might not be explained clearly if only the regulatory pressure variable is considered, and therefore other interactions were added subsequently in Models II and III, so as to discuss how regulatory pressure and control variables influence the adjustment of bank capital adequacy ratio and risk-taking. On the other hand, the coefficient of regulatory pressure obtained from Panel B (risk equation) of Table 3 was significantly negative at 1% and was robust across all specifications (Models I to III). This showed that capital requirements appear to be an effective tool in reducing credit risk-taking on average, a finding consistent with Barth et al. (2004), Kopecky and VanHoose (2006), and Agoraki, et al. (2010).

Table 3 shows that both the change of capital adequacy ratio ($dCAR_{i,t}$) and the change in risk-taking ($dRISK$)

Table 3. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with all of supervisory mechanisms and market discipline indicators.

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \sum_{j=1}^{4} \gamma_{jt}(X_{jt}) + \sum_{j=1}^{3} \lambda_{jt}(Y_{jt}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (1)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \sum_{j=1}^{4} \gamma_{jt}(X_{jt}) + \sum_{j=1}^{3} \lambda_{jt}(Y_{jt}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (2)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$						Variable	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3			Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0905	0.0000***	0.0810	0.0000***	0.0770	0.0000***	Constant	0.0476	0.0000***	0.0653	0.0000***	0.0649	0.0000***
$CAR_{i,t-1}$	-0.1790	0.0000***	-0.1615	0.0000***	-0.1568	0.0000***	$SIZE_{i,t}$	0.0006	0.1394	0.0007	0.0812*	0.0007	0.0829*
$dRISK_{i,t}$	0.3591	0.0000***	0.3641	0.0000***	0.4072	0.0000***	$LLOSS_{i,t}$	0.2362	0.0000***	0.2370	0.0000***	0.2418	0.0000***
$SIZE_{i,t}$	-0.0034	0.0000***	-0.0034	0.0000***	-0.0035	0.0000***	$dCAR_{i,t}$	0.4812	0.0000***	0.4832	0.0000***	0.5105	0.0000***
$ROA_{i,t}$	0.0004	0.0000***	0.0003	0.0001***	0.0003	0.0001***	$REG_{i,t}$	-0.0055	0.0018***	-0.0588	0.0000***	-0.0580	0.0000***
REG_t	-0.0226	0.0000***	0.0165	0.0000***	0.0237	0.0000***	$RISK_{i,t-1}$	-0.1063	0.0000***	-0.1350	0.0000***	-0.1333	0.0000***
$REG_t * dRISK$					-0.3927	0.0000***	$REG_{i,t} * dCAR_i$					-0.2308	0.0000***
$REG_t * CAR_{i,}$			-0.5145	0.0000***	-0.6049	0.0000***	$REG_{i,t} * RISK$			0.0696	0.0000***	0.0677	0.0000***
$GROWTH_t$	-0.0006	0.1358	-0.0010	0.0076***	-0.0008	0.0246**	$GROWTH_t$	0.0015	0.0015***	0.0015	0.0019***	0.0016	0.0012***
$BFREE2_t$	-0.0036	0.0000***	-0.0032	0.0002***	-0.0019	0.0181**	$BFREE2_t$	0.0110	0.0000***	0.0114	0.0000***	0.0112	0.0000***
KK_COMPO	0.0011	0.4358	-0.0022	0.1229	-0.0030	0.0335**	KK_COMPO_t	-0.0033	0.0701*	-0.0035	0.0573*	-0.0031	0.0888*
$CONCEN_t$	0.0062	0.1903	0.0124	0.0079***	0.0132	0.0037***	$CONCEN_t$	-0.0315	0.0000***	-0.0328	0.0000***	-0.0332	0.0000***
$SUPERVIS_t$	-0.0002	0.5623	0.0003	0.5041	0.0000	0.9057	$SUPERVIS_t$	0.0000	0.9982	0.0002	0.7016	0.0001	0.7769
$MCCPG_t$	0.0000	0.0176**	0.0001	0.0029***	0.0001	0.0084***	$MCCPG_t$	-0.0001	0.0000***	-0.0001	0.0000***	-0.0001	0.0000***
$SLRINDEX_t$	-0.0010	0.0101**	-0.0007	0.0625*	-0.0004	0.3363	$SLRINDEX_t$	-0.0001	0.8731	0.0005	0.3376	0.0004	0.3688
$DCPBSPG_t$	0.0000	0.0000***	0.0001	0.0000***	0.0000	0.0000***	$DCPBSPG_t$	0.0001	0.0000***	0.0001	0.0004***	0.0001	0.0003***
$YR2002$	0.0078	0.0004***	0.0081	0.0002***	0.0079	0.0002***	$YR2002$	-0.0037	0.1787	-0.0037	0.1816	-0.0041	0.1430
$YR2003$	0.0016	0.4716	0.0016	0.4429	0.0011	0.6057	$YR2003$	-0.0056	0.0429**	-0.0056	0.0428**	-0.0056	0.0424**
$YR2004$	0.0022	0.3483	0.0031	0.1693	0.0013	0.5650	$YR2004$	-0.0024	0.4193	-0.0024	0.4128	-0.0025	0.3859
$YR2005$	-0.0046	0.0420**	-0.0043	0.0533*	-0.0041	0.0614	$YR2005$	0.0037	0.2008	0.0042	0.1472	0.0042	0.1474

Table 3. Contd.

$YR2006$	-0.0010	0.6757	-0.0006	0.7995	-0.0006	0.7942	$YR2006$	0.0030	0.3142	0.0033	0.2730	0.0032	0.2876
$YR2007$	-0.0017	0.5004	-0.0013	0.5834	-0.0011	0.6256	$YR2007$	0.0045	0.1478	0.0048	0.1247	0.0043	0.1602
R^2	0.2715		0.2924		0.3310		R^2	0.2411		0.2473		0.2501	
Adj. R^2	0.2703		0.2912		0.3298		Adj. R^2	0.2399		0.2460		0.2487	
Durbin-Watson	2.0684		2.0817		2.0428		Durbin-Watson	2.4006		2.3825		2.3706	
F-statistic	102.5250		118.6410		112.8563		F-statistic	60.7545		65.7153		63.5909	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***		Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11669		11669		11669		Obs	11669		11669		11669	

were significantly negative at 1% with the level of lag-one period, meaning the banks set the target capital level to manage recapitalization and risk-taking. When the banks think the capital adequacy ratio is too low, adjustment actions can increase the capital adequacy ratio or decrease the risk assets. On the contrary, an overly high capital adequacy ratio will reduce the capital adequacy ratio or increase the risk-taking. In addition, these coefficients imply the speed of banks adjusting their capital adequacy ratio and risk assets ratio. According to the analytic results of Model I in Table 3, the capital adjustment speed (-0.1790) was about 1.68 times the risk adjustment speed (-0.1063). This implied that if the adjustment speed was observed in a specific view, it could be assumed the capital adequacy ratio and the risky assets ratio would have significant and sudden changes. Banks needed 3.51 and 6.17 years of adjustment to have such an impact, and the aforesaid computing modes were $\ln(0.5)/\ln(1-0.1790)$ and $\ln(0.5)/\ln(1-0.1063)$.

As seen in Panel A (capital equation) of Table 3, the capital adequacy change ($dCAR$) had a significant positive correlation with the risk adjustment ($dRISK$), and had reached a significance level of 1%, presenting a mutual effect in Panel B (risk equation). The results supported the H_1^1 hypothesis, that is, banks with high capital buffer positions will adjust their capital ratio and risk-taking in the same direction, and when at least one of the two coefficients (α_2, β_3) in Equations (1) and (2) is obviously positive $(\alpha_2 > 0)$ or $(\beta_3 > 0)$, then the capital buffer theory is met. On the other hand, the effect of economic growth rate ($GROWTH$) was obviously negative in Panel A (capital equation) of Table 3, and had reached a significance level of 1% in Model II and III, but was significantly positive at 1% in Panel B (risk equation) of Table 3. This showed a change in the macroeconomic environment would highly influence the banks' capital adjustment and risk-taking.

In order to further verify the capital buffer theory, this paper included the interaction of regulatory pressure and changes of capital or risk value in Model III, that is, $REG_t{*}dRISK_t$ and $REG_t{*}dCAR_t$. As indicated in the capital buffer theory proposed by Heid et al. (2004), banks with low capital buffer positions will reconstruct their buffer position, namely increasing capital while reducing risk-taking, or decreasing capital while increasing risk-taking. On the other hand, banks with high capital buffer positions are inclined to maintain their position, namely increasing capital while increasing risk-taking, or decreasing capital while decreasing risk-taking. In Model III of Panel A, the coefficient estimates of $dRISK$ and $REG_t{*}dRISK_t$ in the capital equation were statistically significant positive, the capital adjusting speed was 0.0145, equal to 0.4072 - 0.3927. On the other hand, the coefficient of $dCAR$ in Panel B of Table3 was significantly positive (0.5105) at 1%, whereas the coefficient of $REG_t{*}dCAR_t$ was significantly negative (-0.2308) at 1%, showing that banks with high capital buffer positions were inclined to reduce their capital buffer position, and banks with low capital buffer positions still presented the same direction in the adjustment of capital and risk (equal to 0.5105 - 0.2308 = 0.2797). This showed the behavior of reconstructing the capital buffer position has not yet appeared, but the willingness to maintain the position has increased greatly.

The results suggested that banks with low capital buffers will increase risk when they increase capital, thereby rebuilding their capital buffer. In contrast, banks with high capital buffers will decrease risk when capital increases, thereby maintaining their capital buffer. However, banks with low capital buffers as well as banks with high capital buffers do not adjust capital when risk changes. This finding indicates that the coordination of capital and risk adjustment runs only from capital to risk and not vice versa. Although this study did not expect the coordination to be one-way, the results did not perfectly support H_1^2 , that is, banks with low capital buffer positions will adjust their capital ratio and risk-taking in parallel directions. In addition, in Panel A (capital equation) of Table 3, REG had a significantly positive correlation (0.0237) at 1% within Model III. This result was identical to that expected by this paper, which is to say, the appearance of regulatory pressure will cause banks increase their capital adequacy ratio. However, in Panel B (risk equation) of Table 3, REG had a significantly negative correlation (-0.058) at 1% within Model III with $dRISK$. This was identical to that expected by this paper, meaning banks will reduce their risk-taking under regulatory pressure.

This paper included the interaction of regulatory pressure and the lag-one period level in Model II, that is, $REG_t{*}CAR_{t-1}$ and $REG_t{*}RISK_{t-1}$, so as to validate whether banks have different adjusting speeds for capital and risk-taking in different capital buffer positions. According to Panel A (capital equation) of Table 3, the coefficient of $REG_t{*}CAR_{t-1}$ was significantly negative (-0.5145) at 1%, meaning banks with high capital buffer positions are in a negative direction in the adjustment of capital. The results supported H_1^3 , that is, banks with low capital buffer positions adjust their capital faster than banks with high capital buffers; that is, $\alpha_7 < 0$ in Equation (1). Furthermore, the coefficient of capital regulatory pressure (REG) was significantly positive (0.0165) at 1% after adding to $REG{*}CAR_{t-1}$. This result was identical to that expected by this paper, which is to say, the appearance of regulatory pressure will cause banks to increase their capital adequacy ratio. On the other hand, according to Panel B (risk equation) of Table 3, banks with low capital buffer positions adjust their risk-taking at the speed of 0.0696. This showed the banks will be more passive in the adjustment speed under regulatory pressure. At the same time, the coefficient of the capital regulatory pressure (REG) was significantly negative (-0.0588) at 1% after adding to $REG{*}RISK_{t-1}$. This was identical to that expected by this paper, meaning banks will reduce their risk-taking under regulatory pressure. However, the results did not perfectly supported H_1^3 , that is, banks with low capital buffer positions will not adjust their risk-taking faster than banks with high capital buffers.

On the effects of bank-specific variables, according to Panel A (capital equation) in Table 3, there was a significant negative correlation between bank size ($SIZE$) and capital adequacy change ($dCAR_{i,t}$), and had reached a significance level of 1%, for which this paper deduced three causes. It is easy for large banks to raise funds in capital markets, so they have the motive for holding a lower capital buffer position. Furthermore, Van Roy (2003) and Lindquist (2004) indicated that due to the diversification effect of portfolio theory, large banks are likely to reach diversified benefits, and the lost amount will be lessened after the diversification of risk. Finally, Lindquist (2004) indicated when large banks meet with financial distress, the whole country's economy will be shaken, therefore, as it is expected that the government will provide financial contribution to save these banks, the large banks do not need to hold large amounts of equity capital. On the other hand, Panel A (capital equation) of Table 3 showed a significantly positive correlation at 1% between ROA (ROA) and capital adequacy change ($dCAR_{i,t}$), showing that when banks increase the capital adequacy ratio, the retained earnings is the main source of incremental capital. However, Panel B of Table 4 showed a significantly positive relationship between the loan loss provisions ratio ($LLOSS$) and risk-taking change ($dRISK$), and had reached a significance level of 1%, meaning the deterioration of a bank's asset quality will contrarily cause the bank to bear more risks.

Effects of supervisory mechanism

Table 3 reports the simultaneous equation regression results while considering the four supervisory mechanism indicators simultaneously. In Panel A of Table 3, the study found a negative and significant association between the indicator of relative openness of banking and financial systems ($BFREE2$) and the changes of the capital adequacy ratio ($dCAR$) that was robust across all specifications (Models I to III). The results in Panel A of Table 4 presented a negative and highly significant indication of a considerable level of persistence in the changes of banks' capital adequacy ratio, and the effects were robust across all specifications (Models I to III). In other words, on the same line with the results in Table 3, a higher openness of banking and financial systems ($BFREE2$) results in the banks' lower capital adjustment. However, in Panel B of Table 3, there existed a positive and significant association between the indicator of relative openness of banking and financial systems ($BFREE2$) and the changes of risk-taking ($dRISK$) that was robust across all specifications (Models I to III). The results in Panel B of Table 4 presented a positive and

Table 4. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the supervisory mechanisms indicator ($BFREE2$).

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_1 (X_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (3)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH + \gamma_1 (X_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (4)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$						Variables	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3			Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0842	0.0000***	0.0803	0.0000***	0.0777	0.0000***	Constant	0.0241	0.0003***	0.0445	0.0000***	0.0436	0.0000***
$CAR_{i,t-1}$	-0.1742	0.0000***	-0.1574	0.0000***	-0.1533	0.0000***	$SIZE_{i,t}$	0.0016	0.0000***	0.0016	0.0000***	0.0017	0.0000***
$dRISK_{i,t}$	0.3665	0.0000***	0.3725	0.0000***	0.4164	0.0000***	$LLOSS_{i,t}$	0.2317	0.0000***	0.2362	0.0000***	0.2402	0.0000***
$SIZE_{i,t}$	-0.0030	0.0000***	-0.0029	0.0000***	-0.0031	0.0000***	$dCAR_{i,t}$	0.4822	0.0000***	0.4882	0.0000***	0.5147	0.0000***
$ROA_{i,t}$	0.0003	0.0000***	0.0003	0.0003***	0.0003	0.0004***	$REG_{i,t}$	-0.0025	0.1156	-0.0579	0.0000***	-0.0572	0.0000***
REG_t	-0.0205	0.0000***	0.0172	0.0000***	0.0242	0.0000***	$RISK_{i,t-1}$	-0.0929	0.0000***	-0.1240	0.0000***	-0.1224	0.0000***
$REG_t * dRISK_{i,t}$					-0.4050	0.0000***	$REG_{i,t} * dCAR_{i,t}$					-0.2277	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5039	0.0000***	-0.5963	0.0000***	$REG_{i,t} * RISK_{i,t-1}$			0.0712	0.0000***	0.0695	0.0000***
$GROWTH_t$	-0.0011	0.0000***	-0.0012	0.0000***	-0.0009	0.0007***	$GROWTH_t$	0.0012	0.0006***	0.0014	0.0000***	0.0014	0.0000***
$BFREE2_t$	-0.0020	0.0002***	-0.0018	0.0008***	-0.0010	0.0602*	$BFREE2_t$	0.0065	0.0000***	0.0074	0.0000***	0.0073	0.0000***
$YR2002$	0.0070	0.0009***	0.0072	0.0006***	0.0070	0.0006***	$YR2002$	-0.0015	0.5846	-0.0018	0.5077	-0.0021	0.4330
$YR2003$	0.0022	0.3005	0.0021	0.3192	0.0014	0.5030	$YR2003$	-0.0052	0.0576*	-0.0054	0.0459**	-0.0054	0.0475**
$YR2004$	0.0042	0.0557*	0.0042	0.0550*	0.0019	0.3757	$YR2004$	-0.0029	0.3009	-0.0035	0.2160	-0.0034	0.2216
$YR2005$	-0.0021	0.3465	-0.0021	0.3197	-0.0023	0.2700	$YR2005$	0.0008	0.7638	0.0010	0.7273	0.0011	0.6982
$YR2006$	0.0022	0.3222	0.0023	0.2966	0.0018	0.3874	$YR2006$	-0.0009	0.7432	-0.0009	0.7445	-0.0009	0.7523
$YR2007$	0.0022	0.3232	0.0025	0.2560	0.0021	0.3181	$YR2007$	-0.0022	0.4418	-0.0017	0.5323	-0.0020	0.4679
R^2	0.2668		0.2870		0.3274		R^2	0.2337		0.2407		0.2433	
Adj. R^2	0.2660		0.2861		0.3266		Adj. R^2	0.2329		0.2398		0.2424	
Durbin-Watson	2.0672		2.0768		2.0378		Durbin-Watson	2.4139		2.3900		2.3787	
F-statistic	149.8101		170.5350		159.0185		F-statistic	79.6729		87.1587		82.9368	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***		Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11914		11914		11914		Obs	11914		11914		11914	

highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to III). That is, on the same line with the results in Table 3, a higher openness of banking and financial systems ($BFREE2$) results in higher banks' risk-taking.

KK_COMPO represents a composite of six governance indicators, which are voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and corruption. Higher values correspond to better governance outcomes. In Panel A of Table 3, the study found a negative and significant association between six governance indicators (KK_COMPO) and changes of the capital adequacy ratio ($dCAR$) in Model III.

The results showed that higher governance indicators (KK_COMPO) result in lower banks' capital adjustment. Although the results in Panel A of Table 5 were negative, they were not significant. On the other hand, in Panel B of Table 3, there existed a negative and significant association between the governance indicators (KK_COMPO) and changes of risk-taking ($dRISK$) that was robust across all specifications (Models I to III).

On contrary, the results in Panel B of Table 5 presented a positive and highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to III). Nevertheless, on a different line with the results in Table 3, higher governance indicators (KK_COMPO) result in a higher level of banks' risk-taking.

Furthermore, $SUPERVIS$ represents the principal component indicator of the 14 dummy variables of supervisory agency power. In Panel A of Table 3, the study found no significant association between the indicator of supervisory agency power ($SUPERVIS$) and changes of the capital adequacy ratio ($dCAR$), which was robust across all specifications (Models I to III).

The results in Panel A of Table 6 presented a negative and highly significant indication that a higher indicator of supervisory agency power ($SUPERVIS$) results in lower banks' capital adjustment. Similarly, in Panel B of Table 3, the study found no significant association between the indicator of supervisory agency power ($SUPERVIS$) and the changes of risk -taking ($dRISK$), which was robust across all specifications (Models I to III).

However, the results in Panel B of Table 6 presented a positive and highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to III), showing a higher indicator of supervisory agency power ($SUPERVIS$) results in higher banks' risk-taking.

Finally, $\mathrm{SLRINDEX}$ represents the strength of legal rights index and measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders, with higher scores indicating that these laws are better designed to expand access to credit. In Panel A of Table 3, the study found a negative and significant association between the indicator of the strength of the legal rights index ($\mathrm{SLRINDEX}$) and changes of the capital adequacy ratio ($dCAR$) that was robust across all specifications (Models I to II).

The results in Panel A of Table 7 presented a negative and highly significant indication of a considerable level of persistence in the changes of banks' capital adequacy ratio, and the effects were robust across all specifications (Models I to II).

In other words, on the same line with the results in Table 3, a higher strength of legal rights index ($\mathrm{SLRINDEX}$) results in lower banks' capital adjustment. However, in Panel B of Table 3, the results presented no significant association between the strength of legal rights index ($\mathrm{SLRINDEX}$) and the changes of risk -taking ($dRISK$) that was robust across all specifications (Models I to III).

The results in Panel B of Table 7 presented a positive and highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to III), showing that a higher strength of legal rights index ($\mathrm{SLRINDEX}$) results in higher banks' risk-taking.

Effects of market discipline

Table 3 reports the simultaneous equation regression results while considering three market discipline variables simultaneously. In Panel A of Table 3, the study found a positive and significant association between the concentration indicator ($CONCEN$), measured by the assets of the three largest banks as a share of the assets of all commercial banks, and changes of the capital adequacy ratio ($dCAR$), that was robust across all specifications (Models II and III). In other words, a higher concentration indicator ($CONCEN$) results in higher banks' capital adjustment.

The results in Panel A of Table 8 presented no significant indications of a considerable level of persistence in the changes of banks' capital adequacy ratio, and the effects were robust across all specifications (Models I to III).

However, in Panel B of Table 3, there existed a negative and significant association between the concentration indicator ($CONCEN$) and the changes of risk -taking ($dRISK$) that was robust across all specifications (Models I to III). Similarly, the results in Panel B of Table 8 presented a negative and highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to

Table 5. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the supervisory mechanisms indicator (KK_COMPO)

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_2 (X_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (5)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \gamma_2 (X_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (6)$$

Variable	**Panel A: Dependent variable: $dCAR_{i,t}$**					
	Model 1		**Model 2**		**Model 3**	
	Coefficient	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
Constant	0.0746	0.0000***	0.0738	0.0000***	0.0745	0.0000***
$CAR_{i,t-1}$	-0.1730	0.0000***	-0.1564	0.0000***	-0.1527	0.0000***
$dRISK_{i,t}$	0.3702	0.0000***	0.3757	0.0000***	0.4183	0.0000***
$SIZE_{i,t}$	-0.0029	0.0000***	-0.0029	0.0000***	-0.0031	0.0000***
$ROA_{i,t}$	0.0003	0.0000***	0.0003	0.0004***	0.0003	0.0005***
REG_t	-0.0199	0.0000***	0.0182	0.0000***	0.0249	0.0000***
$REG_t * dRISK_{i,t}$					-0.4081	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5079	0.0000***	-0.5996	0.0000***
$GROWTH_t$	-0.0009	0.0042***	-0.0012	0.0001***	-0.0009	0.0024***
KK_COMPO_t	-0.0003	0.7795	-0.0014	0.1341	-0.0009	0.2996
$YR2002$	0.0067	0.0015***	0.0070	0.0008***	0.0069	0.0006***
$YR2003$	0.0020	0.3632	0.0021	0.3288	0.0014	0.5021
$YR2004$	0.0041	0.0727*	0.0046	0.0402**	0.0021	0.3198
$YR2005$	-0.0022	0.3247	-0.0018	0.4010	-0.0021	0.3272
$YR2006$	0.0018	0.4398	0.0024	0.2757	0.0020	0.3556
$YR2007$	0.0023	0.2986	0.0031	0.1625	0.0025	0.2411
R^2	0.2653		0.2858		0.3272	
Adj. R^2	0.2645		0.2850		0.3263	
Durbin-Watson	2.0661		2.0756		2.0372	
F-statistic	149.7733		170.6490		159.0519	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11914		11914		11914	

Variable	**Panel B: Dependent variable: $dRISK_{i,t}$**					
	Model 1		**Model 2**		**Model 3**	
	Coefficient	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
Constant	0.0464	0.0000***	0.0667	0.0000***	0.0651	0.0000***
$SIZE_{i,t}$	0.0013	0.0013***	0.0013	0.0016***	0.0013	0.0013***
$LLOSS_{i,t}$	0.2180	0.0000***	0.2208	0.0000***	0.2258	0.0000***
$dCAR_{i,t}$	0.4948	0.0000***	0.5013	0.0000***	0.5306	0.0000***
$REG_{i,t}$	-0.0040	0.0135**	-0.0532	0.0000***	-0.0526	0.0000***
$RISK_{i,t-1}$	-0.0868	0.0000***	-0.1136	0.0000***	-0.1121	0.0000***
$REG_{i,t} * dCAR_{i,t}$					-0.2537	0.0000***
$REG_{i,t} * RISK_{i,t-1}$			0.0630	0.0000***	0.0613	0.0000***
$GROWTH_t$	0.0009	0.0190**	0.0012	0.0033***	0.0012	0.0023***
KK_COMPO_t	0.0029	0.0156**	0.0035	0.0030***	0.0036	0.0023***
$YR2002$	-0.0009	0.7530	-0.0011	0.6925	-0.0015	0.5895
$YR2003$	-0.0047	0.0854*	-0.0049	0.0714*	-0.0049	0.0718*
$YR2004$	-0.0035	0.2211	-0.0042	0.1407	-0.0042	0.1395
$YR2005$	0.0004	0.8959	0.0003	0.9103	0.0004	0.8892
$YR2006$	-0.0007	0.8151	-0.0008	0.7867	-0.0008	0.7752
$YR2007$	-0.0036	0.2041	-0.0036	0.2104	-0.0039	0.1692
R^2	0.2293		0.2348		0.2375	
Adj. R^2	0.2284		0.2339		0.2366	
Durbin-Watson	2.4123		2.3904		2.3779	
F-statistic	74.8403		80.7557		76.7320	
Prob (F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11914		11914		11914	

Table 6. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the supervisory mechanisms indicator ($SUPERVIS$).

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_3 (X_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (7)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \gamma_3 (X_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (8)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0794	0.0000***	0.0734	0.0000***	0.0748	0.0000***
$CAR_{i,t-1}$	-0.1733	0.0000***	-0.1564	0.0000***	-0.1528	0.0000***
$dRISK_{i,t}$	0.3709	0.0000***	0.3766	0.0000***	0.4187	0.0000***
$SIZE_{i,t}$	-0.0028	0.0000***	-0.0028	0.0000***	-0.0030	0.0000***
$ROA_{i,t}$	0.0003	0.0000***	0.0003	0.0003***	0.0003	0.0004***
REG_t	-0.0203	0.0000***	0.0175	0.0000***	0.0244	0.0000***
$REG_t * dRISK_{i,t}$					-0.4087	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5035	0.0000***	-0.5963	0.0000***
$GROWTH_t$	-0.0010	0.0002***	-0.0010	0.0001***	-0.0008	0.0020***
$SUPERVIS_t$	-0.0008	0.0231**	-0.0003	0.3506	-0.0003	0.3816
$YR2002$	0.0068	0.0014***	0.0069	0.0010***	0.0069	0.0007***
$YR2003$	0.0020	0.3458	0.0019	0.3751	0.0013	0.5398
$YR2004$	0.0038	0.0851*	0.0039	0.0765*	0.0017	0.4322
$YR2005$	-0.0024	0.2641	-0.0024	0.2645	-0.0025	0.2366
$YR2006$	0.0015	0.4963	0.0017	0.4306	0.0015	0.4763
$YR2007$	0.0021	0.3470	0.0025	0.2603	0.0021	0.3271
R^2	0.2655		0.2856		0.3271	
Adj. R^2	0.2647		0.2847		0.3263	
Durbin-Watson	2.0660		2.0753		2.0373	
F-statistic	150.6086		170.8608		159.2083	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11914		11914		11914	

Variable	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0399	0.0000***	0.0598	0.0000***	0.0587	0.0000***
$SIZE_{i,t}$	0.0012	0.0020***	0.0012	0.0027***	0.0012	0.0024***
$LLOSS_{i,t}$	0.2090	0.0000***	0.2100	0.0000***	0.2148	0.0000***
$dCAR_{i,t}$	0.4904	0.0000***	0.4964	0.0000***	0.5246	0.0000***
$REG_{i,t}$	-0.0029	0.0678*	-0.0540	0.0000***	-0.0533	0.0000***
$RISK_{i,t-1}$	-0.0901	0.0000***	-0.1187	0.0000***	-0.1170	0.0000***
$REG_{i,t} * dCAR_{i,t}$					-0.2422	0.0000***
$REG_{i,t} * RISK_{i,t-1}$			0.0656	0.0000***	0.0639	0.0000***
$GROWTH_t$	0.0006	0.0614*	0.0008	0.0181**	0.0008	0.0158**
$SUPERVIS_t$	0.0021	0.0000***	0.0025	0.0000***	0.0024	0.0000***
$YR2002$	-0.0007	0.7952	-0.0009	0.7416	-0.0013	0.6424
$YR2003$	-0.0044	0.1052	-0.0046	0.0932*	-0.0045	0.0954*
$YR2004$	-0.0017	0.5413	-0.0021	0.4657	-0.0020	0.4692
$YR2005$	0.0019	0.4877	0.0022	0.4217	0.0023	0.4038
$YR2006$	0.0011	0.6961	0.0014	0.6188	0.0014	0.6220
$YR2007$	-0.0020	0.4864	-0.0015	0.5884	-0.0018	0.5143
R^2	0.2300		0.2360		0.2387	
Adj. R^2	0.2292		0.2351		0.2377	
Durbin-Watson	2.4087		2.3853		2.3734	
F-statistic	75.6213		82.0020		78.0040	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11914		11914		11914	

Table 7. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the supervisory mechanisms indicator ($SLRINDEX$)

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \gamma_4 (X_{4t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (9)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \gamma_4 (X_{4t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + v_{i,t} \quad (10)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$						Variable	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3			Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0804	0.0000***	0.0769	0.0000***	0.0765	0.0000***	Constant	0.0418	0.0000***	0.0623	0.0000***	0.0609	0.0000***
$CAR_{i,t-1}$	-0.1761	0.0000***	-0.1589	0.0000***	-0.1548	0.0000***	$SIZE_{i,t}$	0.0012	0.0040***	0.0011	0.0066***	0.0011	0.0058***
$dRISK_{i,t}$	0.3679	0.0000***	0.3738	0.0000***	0.4160	0.0000***	$LLOSS_{i,t}$	0.2188	0.0000***	0.2209	0.0000***	0.2258	0.0000***
$SIZE_{i,t}$	-0.0029	0.0000***	-0.0029	0.0000***	-0.0031	0.0000***	$dCAR_{i,t}$	0.4850	0.0000***	0.4886	0.0000***	0.5168	0.0000***
$ROA_{i,t}$	0.0003	0.0001***	0.0003	0.0007***	0.0003	0.0006***	$REG_{i,t}$	-0.0046	0.0053***	-0.0574	0.0000***	-0.0567	0.0000***
REG_t	-0.0201	0.0000***	0.0177	0.0000***	0.0244	0.0000***	$RISK_{i,t-1}$	-0.0898	0.0000***	-0.1191	0.0000***	-0.1176	0.0000***
$REG_t * dRISK_{i,t}$					-0.4058	0.0000***	$REG_{i,t} * dCAR_{i,t}$					-0.2425	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5075	0.0000***	-0.6001	0.0000***	$REG_{i,t} * RISK_{i,t-1}$			0.0677	0.0000***	0.0660	0.0000***
$GROWTH_t$	-0.0011	0.0001***	-0.0013	0.0000***	-0.0009	0.0005***	$GROWTH_t$	0.0008	0.0363**	0.0010	0.0056***	0.0010	0.0047***
$SLRINDEX_t$	-0.0007	0.0225**	-0.0006	0.0519*	-0.0003	0.3010	$SLRINDEX_t$	0.0020	0.0000***	0.0024	0.0000***	0.0024	0.0000***
$YR2002$	0.0068	0.0017***	0.0070	0.0011***	0.0069	0.0008***	$YR2002$	-0.0009	0.7580	-0.0010	0.7072	-0.0014	0.6091
$YR2003$	0.0020	0.3566	0.0019	0.3712	0.0012	0.5536	$YR2003$	-0.0047	0.0894*	-0.0049	0.0773*	-0.0048	0.0786*
$YR2004$	0.0044	0.0520*	0.0044	0.0492**	0.0020	0.3557	$YR2004$	-0.0030	0.2903	-0.0037	0.1959	-0.0037	0.1988
$YR2005$	-0.0020	0.3738	-0.0021	0.3407	-0.0023	0.2873	$YR2005$	0.0007	0.8171	0.0006	0.8431	0.0007	0.8110
$YR2006$	0.0023	0.3051	0.0024	0.2781	0.0020	0.3699	$YR2006$	-0.0009	0.7624	-0.0011	0.7029	-0.0011	0.7048
$YR2007$	0.0031	0.1661	0.0034	0.1304	0.0027	0.2157	$YR2007$	-0.0044	0.1291	-0.0045	0.1165	-0.0048	0.0944
R^2	0.2669		0.2874		0.3283		R^2	0.2307		0.2369		0.2399	
Adj. R^2	0.2661		0.2865		0.3274		Adj. R^2	0.2299		0.2360		0.2389	
Durbin-Watson	2.0645		2.0747		2.0374		Durbin-Watson	2.4157		2.3934		2.3812	
F-statistic	147.7267		168.0716		156.6408		F-statistic	74.7793		81.1924		77.1007	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***		Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11669		11669		11669		Obs	11669		11669		11669	

Table 8. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the market discipline indicator ($CONCEN$).

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \lambda_1(Y_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (11)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \lambda_1(Y_{1t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (12)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0750	0.0000***	0.0723	0.0000***	0.0724	0.0000***
$CAR_{i,t-1}$	-0.1729	0.0000***	-0.1562	0.0000***	-0.1525	0.0000***
$dRISK_{i,t}$	0.3712	0.0000***	0.3770	0.0000***	0.4193	0.0000***
$SIZE_{i,t}$	-0.0029	0.0000***	-0.0029	0.0000***	-0.0030	0.0000***
$ROA_{i,t}$	0.0003	0.0000***	0.0003	0.0003***	0.0003	0.0004***
REG_t	-0.0200	0.0000***	0.0178	0.0000***	0.0247	0.0000***
$REG_t * dRISK_{i,t}$					-0.4093	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5053	0.0000***	-0.5980	0.0000***
$GROWTH_t$	-0.0009	0.0009***	-0.0010	0.0001***	-0.0007	0.0037***
$CONCEN_t$	-0.0012	0.7458	-0.0015	0.6842	0.0004	0.9016
$YR2002$	0.0067	0.0016***	0.0069	0.0010***	0.0069	0.0007***
$YR2003$	0.0019	0.3709	0.0018	0.3846	0.0012	0.5526
$YR2004$	0.0040	0.0744*	0.0039	0.0712*	0.0017	0.4222
$YR2005$	-0.0022	0.3114	-0.0023	0.2935	-0.0024	0.2460
$YR2006$	0.0017	0.4464	0.0019	0.3970	0.0015	0.4733
$YR2007$	0.0023	0.2986	0.0026	0.2322	0.0021	0.3239
R-squared	0.2652		0.2854		0.3270	
Adj. R-square	0.2644		0.2846		0.3262	
Durbin-Watson	2.0658		2.0753		2.0371	
F-statistic	149.9633		170.7973		159.1679	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11914		11914		11914	

Variable	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0760	0.0000***	0.0970	0.0000***	0.0956	0.0000***
$SIZE_{i,t}$	0.0006	0.1368	0.0006	0.1700	0.0006	0.1609
$LLOSS_{i,t}$	0.2077	0.0000***	0.2092	0.0000***	0.2141	0.0000***
$dCAR_{i,t}$	0.4961	0.0000***	0.5031	0.0000***	0.5329	0.0000***
$REG_{i,t}$	-0.0047	0.0037***	-0.0528	0.0000***	-0.0522	0.0000***
$RISK_{i,t-1}$	-0.0913	0.0000***	-0.1174	0.0000***	-0.1159	0.0000***
$REG_{i,t} * dCAR_{i,t}$					-0.2586	0.0000***
$REG_{i,t} * RISK_{i,t-1}$			0.0617	0.0000***	0.0600	0.0000***
$GROWTH_t$	-0.0001	0.7632	0.0000	0.9853	0.0000	0.9329
$CONCEN_t$	-0.0298	0.0000***	-0.0298	0.0000***	-0.0301	0.0000***
$YR2002$	-0.0006	0.8270	-0.0008	0.7793	-0.0012	0.6709
$YR2003$	-0.0040	0.1401	-0.0041	0.1298	-0.0041	0.1323
$YR2004$	-0.0016	0.5782	-0.0020	0.4851	-0.0019	0.4937
$YR2005$	0.0029	0.3032	0.0031	0.2719	0.0032	0.2529
$YR2006$	0.0026	0.3531	0.0028	0.3163	0.0029	0.3129
$YR2007$	-0.0002	0.9355	0.0001	0.9731	-0.0002	0.9437
R-squared	0.2314		0.2367		0.2394	
Adj. R-square	0.2306		0.2358		0.2385	
Durbin-Watson	2.4085		2.3868		2.3740	
F-statistic	78.3020		83.7836		79.5106	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	7651		7651		7651	

III). That is, on the same line with the results in Table 3, a higher concentration indicator ($CONCEN$) results in higher banks' risk-taking.

Furthermore, $MCCPG$ represents the market capitalization (also known as market value), which is the share price multiplied by the number of shares outstanding. In Panel A of Table 3, the study found a positive and significant association between market capitalization ($MCCPG$) and changes of the capital adequacy ratio ($dCAR$) that was robust across all specifications (Models II to III).

That is, a higher market capitalization ($MCCPG$) results in higher banks' capital adjustment. However, the results in Panel A of Table 9 presented no significant indications of a considerable level of persistence in the changes of banks' capital adequacy ratio, and the effects were robust across all specifications (Models I to III). On the other hand, in Panel B of Table 3, there existed a negative and significant association between market capitalization ($MCCPG$) and the changes of risk -taking ($dRISK$) that was robust across all specifications (Models I to III). On the contrary, the results in Panel B of Table 9 presented a positive and highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to III). That is, a higher market capitalization ($MCCPG$) results in higher banks' risk-taking.

Finally, $DCPBSPG$ represents domestic credit provided by the banking sector, and includes all credit to various sectors on a gross basis. In Panel A of Table 3, the study found a positive and significant association between domestic credit provided by the banking sector ($DCPBSPG$) and changes of the capital adequacy ratio ($dCAR$) that was robust across all specifications (Models II to III).

That is, higher domestic credit provided by the banking sector ($DCPBSPG$) results in higher banks' capital adjustment. Similarly, the result in Panel A of Table 10 presented a positive and highly significant indication of a considerable level of persistence in the changes of banks' capital adequacy ratio, and the effects were robust across all specifications (Models I to III). In other words, on the same line as the results in Table 3, higher domestic credit provided by the banking sector ($DCPBSPG$) results in lower banks' capital adjustment. On the other hand, in Panel B of Table 3, there existed a positive and significant association between domestic credit provided by the banking sector ($DCPBSPG$) and the changes of risk - taking ($dRISK$) that was robust across all specifications (Models I to III).

In the same way, the results in Panel B of Table 10 presented a positive and highly significant indication of a considerable level of persistence in the changes of banks' risk-taking, and the effects were robust across all specifications (Models I to III).

That is, higher domestic credit provided by the banking sector ($DCPBSPG$) results in higher banks' risk-taking.

Overall, Tables 4 to 10 show that when considering supervisory mechanisms or market discipline individually, the effects of the aforementioned variables were on the same line with the results in Table 3.

CONCLUDING REMARKS

This study revised the simultaneous equations model proposed by Shrieves and Dahl (1992) to investigate whether capital regulations had effects on bank capital and risk-taking adjustment or whether their effects were channeled through supervisory mechanisms or market discipline by using 2SLS and 3SLS, and analyzed the interaction between capital regulations and credit risk-taking for banks.

The supervisory mechanisms considered were the indicator of relative openness of banking and financial systems, six governance indicators, the principal component indicator of supervisors, and the strength of legal rights index.

The market discipline measures were asset concentration, market capitalization and domestic credit provided by the banking sector. This study used data from 1,702 banks from 42 countries during the period 2000 to 2007 to verify the capital buffer theory (Marcus, 1984; Milne and Whalley, 2001).

An important finding was that the empirical results supported the hypotheses proposed in this paper. That is, banks with high capital buffer positions will adjust their capital ratio and risk-taking in the same direction, and banks with low capital buffer positions adjust their capital faster than banks with high capital buffers.

The empirical results suggest that banks with stringent supervisory mechanisms tend to engage in slow adjustments of the capital buffer, but take on higher risk-adjusted credit. However, the impact of market discipline is compared in the opposite direction.

That is, banks with sufficient market discipline tend to take on fast adjustments of the capital buffer, but take on lower risk-adjusted credit. These results clearly suggest that regulations alone may not be adequate to control credit risk-taking and that thorough investigation of supervisory mechanisms and market discipline are also required.

Furthermore, ignoring the interactions between regulations and the adjustment of capital and risk could lead to erroneous inferences about the impact of regulations on credit risk-taking.

The results imply that incentives and tools that enhance market power self-monitoring may promote reductions in risk-taking. The objective of this paper was to provide some insight in the aftermath of the global financial crisis.

Table 9. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the market discipline indicator ($MCCPG$).

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \lambda_2 (\Upsilon_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (13)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \lambda_2 (\Upsilon_{2t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (14)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0748	0.0000***	0.0717	0.0000***	0.0730	0.0000***
$CAR_{i,t-1}$	-0.1748	0.0000***	-0.1578	0.0000***	-0.1541	0.0000***
$dRISK_{i,t}$	0.3687	0.0000***	0.3745	0.0000***	0.4164	0.0000***
$SIZE_{i,t}$	-0.0029	0.0000***	-0.0029	0.0000***	-0.0031	0.0000***
$ROA_{i,t}$	0.0003	0.0000***	0.0003	0.0002***	0.0003	0.0003***
REG_t	-0.0202	0.0000***	0.0177	0.0000***	0.0245	0.0000***
$REG_t * dRISK_{i,t}$					-0.4069	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5088	0.0000***	-0.6013	0.0000***
$GROWTH_t$	-0.0009	0.0006***	-0.0011	0.0001***	-0.0008	0.0014***
$MCCPG_t$	0.0000	0.4654	0.0000	0.3237	0.0000	0.1826
$YR2002$	0.0069	0.0016***	0.0071	0.0009***	0.0071	0.0006***
$YR2003$	0.0018	0.3995	0.0018	0.4126	0.0011	0.5925
$YR2004$	0.0039	0.0856*	0.0039	0.0801*	0.0016	0.4555
$YR2005$	-0.0026	0.2382	-0.0027	0.2154	-0.0028	0.1926
$YR2006$	0.0013	0.5808	0.0014	0.5463	0.0010	0.6396
$YR2007$	0.0019	0.4043	0.0022	0.3486	0.0016	0.4824
R^2	0.2665		0.2870		0.3283	
Adj. R^2	0.2657		0.2862		0.3274	
Durbin-Watson	2.0655		2.0758		2.0381	
F-statistic	147.3694		167.8750		156.4471	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11669		11669		11669	

Variable	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0475	0.0000***	0.0686	0.0000***	0.0670	0.0000***
$SIZE_{i,t}$	0.0012	0.0031***	0.0011	0.0047***	0.0012	0.0041***
$LLOSS_{i,t}$	0.2247	0.0000***	0.2279	0.0000***	0.2331	0.0000***
$dCAR_{i,t}$	0.4984	0.0000***	0.5050	0.0000***	0.5352	0.0000***
$REG_{i,t}$	-0.0037	0.0257**	-0.0538	0.0000***	-0.0531	0.0000***
$RISK_{i,t-1}$	-0.0890	0.0000***	-0.1167	0.0000***	-0.1151	0.0000***
$REG_{i,t} * dCAR_{i,t}$					-0.2594	0.0000***
$REG_{i,t} * RISK_{i,t}$			0.0646	0.0000***	0.0627	0.0000***
$GROWTH_t$	0.0004	0.2365	0.0006	0.1061	0.0006	0.0922*
$MCCPG_t$	0.0001	0.0002***	0.0001	0.0000***	0.0001	0.0000***
$YR2002$	0.0002	0.9569	0.0002	0.9452	-0.0002	0.9361
$YR2003$	-0.0045	0.1026	-0.0046	0.0931*	-0.0046	0.0948*
$YR2004$	-0.0028	0.3237	-0.0034	0.2341	-0.0034	0.2381
$YR2005$	0.0008	0.7757	0.0008	0.7840	0.0009	0.7489
$YR2006$	-0.0013	0.6504	-0.0016	0.5833	-0.0016	0.5888
$YR2007$	-0.0055	0.0653	-0.0058	0.0503	-0.0061	0.0397
R^2	0.2307		0.2363		0.2391	
Adj. R^2	0.2298		0.2354		0.2381	
Durbin-Watson	2.4085		2.3856		2.3730	
F-statistic	74.9408		81.0773		76.9661	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11669		11669		11669	

Table 10. Simultaneous equation system regression results (3SLS) between the changes of capital and risk-taking with one of the market discipline indicator ($DCPBSPG$)

$$dCAR_{i,t} = \alpha_0 + \alpha_1 CAR_{i,t-1} + \alpha_2 dRISK_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 REG_t + \alpha_6 (REG_t * dRISK_{i,t}) + \alpha_7 (REG_t * CAR_{i,t-1}) + \alpha_8 GROWTH_t + \lambda_3 (Y_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \varepsilon_{i,t} \quad (15)$$

$$dRISK_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 LLOSS_{i,t} + \beta_3 dCAR_{i,t} + \beta_4 REG_{i,t} + \beta_5 RISK_{i,t-1} + \beta_6 (REG_{i,t} * dCAR_{i,t}) + \beta_7 (REG_{i,t} * RISK_{i,t-1}) + \beta_8 GROWTH_t + \lambda_3 (Y_{3t}) + \sum_{T=2002}^{2007} \delta_T (YR_T) + \nu_{i,t} \quad (16)$$

Variable	Panel A: Dependent variable: $dCAR_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0749	0.0000***	0.0721	0.0000***	0.0738	0.0000***
$CAR_{i,t-1}$	-0.1753	0.0000***	-0.1583	0.0000***	-0.1547	0.0000***
$dRISK_{i,t}$	0.3674	0.0000***	0.3731	0.0000***	0.4145	0.0000***
$SIZE_{i,t}$	-0.0033	0.0000***	-0.0033	0.0000***	-0.0034	0.0000***
$ROA_{i,t}$	0.0004	0.0000***	0.0003	0.0001***	0.0003	0.0001***
REG_t	-0.0215	0.0000***	0.0165	0.0000***	0.0234	0.0000***
$REG_t * dRISK_{i,t}$					-0.4035	0.0000***
$REG_t * CAR_{i,t-1}$			-0.5100	0.0000***	-0.6015	0.0000***
$GROWTH_t$	-0.0003	0.2706	-0.0005	0.1276	-0.0003	0.2950
$DCPBSPG_t$	0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0001***
$YR2002$	0.0067	0.0021***	0.0069	0.0013***	0.0068	0.0010***
$YR2003$	0.0014	0.5260	0.0013	0.5481	0.0007	0.7248
$YR2004$	0.0027	0.2385	0.0026	0.2351	0.0006	0.7691
$YR2005$	-0.0037	0.1007	-0.0038	0.0870*	-0.0036	0.0945*
$YR2006$	0.0000	0.9902	0.0002	0.9447	0.0002	0.9275
$YR2007$	0.0009	0.6888	0.0012	0.5946	0.0010	0.6407
R^2	0.2678		0.2885		0.3292	
Adj. R^2	0.2670		0.2876		0.3283	
Durbin-Watson	2.0664		2.0780		2.0399	
F-statistic	148.1051		168.6859		157.1452	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11669		11669		11669	

Variable	Panel B: Dependent variable: $dRISK_{i,t}$					
	Model 1		Model 2		Model 3	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	0.0547	0.0000***	0.0737	0.0000***	0.0721	0.0000***
$SIZE_{i,t}$	0.0006	0.1395	0.0006	0.1247	0.0006	0.1215
$LLOSS_{i,t}$	0.2284	0.0000***	0.2283	0.0000***	0.2340	0.0000***
$dCAR_{i,t}$	0.4986	0.0000***	0.5055	0.0000***	0.5367	0.0000***
$REG_{i,t}$	-0.0067	0.0001***	-0.0508	0.0000***	-0.0501	0.0000***
$RISK_{i,t-1}$	-0.0959	0.0000***	-0.1188	0.0000***	-0.1173	0.0000***
$REG_{i,t} * dCAR_{i,t}$					-0.2696	0.0000***
$REG_{i,t} * RISK_{i,t-1}$			0.0574	0.0000***	0.0554	0.0000***
$GROWTH_t$	0.0015	0.0002***	0.0014	0.0002***	0.0015	0.0001***
$DCPBSPG_t$	0.0001	0.0000***	0.0001	0.0000***	0.0001	0.0000***
$YR2002$	-0.0010	0.7207	-0.0011	0.6857	-0.0015	0.5776
$YR2003$	-0.0053	0.0579*	-0.0052	0.0605*	-0.0052	0.0605*
$YR2004$	-0.0046	0.1123	-0.0046	0.1095	-0.0046	0.1065
$YR2005$	-0.0004	0.8817	0.0001	0.9740	0.0002	0.9561
$YR2006$	-0.0021	0.4637	-0.0015	0.6018	-0.0016	0.5833
$YR2007$	-0.0054	0.0631*	-0.0047	0.1049	-0.0051	0.0777*
R^2	0.2325		0.2370		0.2398	
Adj. R^2	0.2317		0.2361		0.2389	
Durbin-Watson	2.3950		2.3770		2.3634	
F-statistic	79.2681		82.9263		78.5300	
Prob(F-statistic)	0.0000***		0.0000***		0.0000***	
Obs	11669		11669		11669	

REFERENCES

Aggarwal R, Jacques KT (1998). Assessing the impact of prompt corrective action on bank capital and risk. Federal Reserve Bank of New York. Econ. Pol. Rev., pp. 23-32.

Aggarwal R, Jacques KT (2001). The impact of FDICIA and prompt corrective action on bank capital and risk: Estimates using a simultaneous equations model. J. Bank. Financ., 25(6): 1139-1160.

Agoraki MEK, Delis MD, Pasiouras F (2010). Regulations, competition and bank risk-taking in transition countries. In Press, Available online 6 September 2009. http://www.elsevier.com/locate/jfstabil. J. Financ. Stab.

Avery RB, Berger AN (1991). Loan commitments and bank risk exposure. J. Bank. Financ., 15(1): 173-192.

Barth JR, Caprio G, Levine R (2004). Bank regulation and supervision: What worked best? J. Financ. Intermed., 13(2): 205-248.

Berger A, Herring R, Szego G (1995). The role of capital in financial institutions. J. Bank. Financ., 19(3-4): 393-430.

Ediz T, Michael I, Perraudin W (1998). The impact of capital requirements on UK bank behavior. Federal Reserve Bank of New York. Econ. Pol Rev., 4(3): 15-22.

Godlewski C (2004). Capital regulation and credit risk taking: Empirical evidence from banks in emerging market economies. Working Paper. large Research Center, University of Strasbourg, EM Strasbourg Business School.

Godlewski CJ (2007). Are ratings consistent with default probabilities? Empirical evidence on banks in emerging market economies. Emerg. Mark. Financ. Tr., 43(4): 5-23.

Hall MJB (1990). The bank for international settlements capital adequacy 'Rules': Implications for banks operating in the UK. Serv. Ind. J., 10(1): 147-171.

Hall MJB (1997). The capital adequacy directive: Implications for UK-Incorporated banks. Serv. Ind. J., 17(2): 320-352.

Hart OD, Jaffee DM (1974). On the application of portfolio theory to depository financial intermediaries. Rev. Econ. Stud., 41(1): 129-147.

Heid F, Porath D, Stolz S (2004). Does capital regulation matter for bank behaviour? Evidence for German savings banks. Discussion Paper Series 2. no 3, Deutsche Bundesbank, Research Centre. Bank. Financ. Stud.,

Holzmüller I (2009). The United States RBC standards, solvency II and the Swiss solvency test: A comparative assessment. Geneva Pap. R. I-ISS. P. 34(2): 56–77.

Hsiao C (1985). Benefits and limitations of panel data. Econ. Rev., 4(1): 121-74.

Intrilligator MD (1978). Econometric Methods, Techniques and Applications. New Jersey: Prentice Hall, Englewood Cliffs.

Jacques K, Nigro P (1997). Risk-based capital, portfolio risk, and bank capital: A simultaneous equations approach. J. Econ. Bus., 49(6): 533-547.

Jeitschko TD, Jeung SD (2005). Incentives for risk-taking in banking: A unified approach. J. Bank. Financ., 29(3): 759-777.

Karp T (2007). International solvency requirements: Towards more risk-based regimes. Geneva Pap. R. I-ISS. P. 32(3): 364–381.

Keeley MC, Furlong FT (1990). A reexamination of mean-variance analysis of bank capital regulation. J. Bank. Financ., 14(1): 69-84.

Kopecky KJ, VanHoose D (2006). Capital regulation, heterogeneous monitoring costs, and aggregate loan quality. J. Bank. Financ., 30(8): 2235-2255.

Liebwein P (2006). Risk models for capital adequacy: Applications in the context of solvency II and beyond. Geneva Pap. R. I-ISS. P. 31(3): 528–550.

Lindquist KG (2004). Banks' buffer capital: How important is risk? J. Int. Money Financ., 23(3): 493-513.

Marcus AJ (1984). Deregulation and bank financial policy. J. Bank. Financ., 8(4): 557-565.

Matejašák M, Teplý P (2007). Regulation of bank capital and behavior of banks: Assessing the US and the EU-15 region banks in the 2000-2005 periods. Working Papers IES 2007/23, Charles University Prague, Faculty of Social Sciences, Institute of Economic Studies.

Milne A, Whalley E (2001). Bank capital regulation and incentives for risk-taking. Cass Business School Research Paper.

Murinde V, Yaseen H (2004). The impact of Basle Accord regulations on bank capital and risk behaviour: 3D evidence from the Middle East and North Africa (MENA) region. Third International Conference of the Centre for Regulation and Competition (CRC), on Pro-Poor Regulation and Competition: Issues, Policies and Practices. Cape Town, 7-9 September.

Myers SC, Majluf NS (1984). Corporate financing and investment decisions when firms have information that investors do not have. NBER Working Paper No. W1396 .

Rime B (2001). Capital requirements and bank behavior: Empirical evidence for Switzerland. J. Bank. Financ., 25(4): 789-805.

Shrieves RE, Dahl D (1992). The relationship between risk and capital in commercial banks. J. Bank. Financ., 16(2): 439-457.

Staikouras SK (2005). Multinational banks, credit risk, and financial crises: A qualitative response analysis. Emerg. Mark. Financ. Tr., 41(2): 82-106.

Thornton J (1992). Market failure and bank regulation. Serv. Ind. J., 12(2): 185-192.

Van Roy P (2005). Impact of the 1988 Basel Accord on banks' capital ratios and credit risk taking: an international study. European Center for Advanced Research in Economics and Statistics (ECARES), Universite Libre de Bruxelles, Working Paper.

Von Bomhard N, Frey C (2006). Future financial frameworks: Essentials for risk-based capital management. Geneva Pap. R. I-ISS. P. 31(1): 46-56.

Zellner A (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. J. Am. Stat. Assoc., 57(298): 348–368.