"ผลกระทบของเกณฑ์การกำกับดูแลเงินกองทุนที่มีต่อฐานะการดำเนินงานและความเสี่ยงของธนาคารพาณิชย์ไทย"

The Impact of Regulatory Pressures on Capital and Portfolio Risk: An Empirical Study of Thai Commercial Banks

จิตเกษม พรประพันธ์*
Chitkasem Pornprapunt*

* ผู้บริหารทีม สายกำกับสถาบันการเงินธนาคารแห่งประเทศไทย
นักศึกษาปริญญาเอก หลักสูตรนานาชาติ คณะรัฐประศาสนศาสตร์ สถาบันพัฒนบริหารศาสตร์
* ข้อคิดเห็นที่ปรากฏในบทความนี้ เป็นความเห็นของผู้เขียน ซึ่งไม่จำเป็นต้องสอดคล้องกับความคิดเห็นของธนาคารแห่งประเทศไทย
* Team Executive, Supervision Group, Bank of Thailand, and Ph.D candidate, Intemational Program, Public Administration Faculty, National Institute of Development Administration (NIDA)
* This view expressed in this paper are those of the author and do not necessarily represent those of Bank of Thailand.

บทคัดย่อ

นโยบายของธนาคารกลางและผู้กำกับดูแลสถาบันการเงินมุ่งรักษาเสถียรภาพระบบสถาบันการเงินโดยเน้นการกำกับดูแลความมั่นคงแข็งแกร่งของสถาบันการเงิน การออกกฎเกณฑ์มาตรฐานขั้นต่ำการดำรงเงินกองทุนตามมาตรฐานสากล (Basel I) ยังเป็นข้อถกเถียงทั้งในเชิงทฤษฎีและภาคปฏิบัติโดยกฎเกณฑ์ดังกล่าวอาจส่งผลให้สถาบันการเงินเพิ่มเงินกองทุน และลดความเสี่ยงทางการเงิน ในอีกด้านหนึ่งการที่สถาบันการเงินมีเงินกองทุนเพิ่มขึ้นก็ส่งผลให้ Leverage เพิ่มขึ้น และความเสี่ยงเพิ่มสูงขึ้นจากปัญหาการบิดเบือนทางจริยธรรม (Moral Hazard) ของสถาบันการเงิน บทความนี้มุ่งศึกษาเชิงประจักษ์เกี่ยวกับผลกระทบของเกณฑ์การกำกับดูแลเงินทุนของทางการที่มีต่อฐานะเงินกองทุนและความเสี่ยงทางการเงิน โดยใช้ข้อมูลของธนาคารพาณิชย์ไทยเพื่อวิเคราะห์เชิงปริมาณจากสมการถดถอย Simultaneous Equations ตามวิธี Generalized Method of Moments (GMM) ซึ่งเน้นศึกษาผลกระทบของตัวแปรนโยบายด้านมาตรการป้องกันและแก้ปัญหาเงินกองทุน ผลการศึกษาพบว่าเกณฑ์การกำกับดูแลเงินกองทุนส่งผลให้ธนาคารพาณิชย์มีการปรับตัวทางด้านฐานะเงินกองทุนและความเสี่ยงทางการเงิน และพบว่าเงินกองทุนและความเสี่ยงทางเงินของธนาคารพาณิชย์มีความสัมพันธ์กันในเชิงผกผัน

คำสำคัญ : เกณฑ์การกำกับดูแลเงินกองทุน เงินกองทุนรวมความเสี่ยง ความเสี่ยงทางการเงิน (Portfolio Risk) มาตรฐานสากล Basel การบิดเบือนทางจริยธรรม และธนาคารพาณิชย์ไทย

Abstract

Policy makers maintain financial stability focusing on banks' financial solvency strengthening. The implementation of regulatory capital minimum requirement, namely, the Basel I Capital Accord has brought about controversy among theorists and practitioners whether the regulation enhances capitalization and portfolio risk mitigation, or it increases leverage, and hence excessive risk taking arisen from moral hazard problem. This study empirically investigates the impact of regulatory capital standard on Thai commercial banks using Generalized Method of Moments (GMM) for simultaneous equations estimation on the panel data. As existed in the literature, the main focus of the estimates is on variables of three dummy regulatory standards including: Prompt Corrective Action (PCA) based, PCA advanced, and capital volatility approaches. The results show that the regulatory capital requirement induces Thai commercial banks to adjust their capital and portfolio risk. The relationship between banks' capital and risk is negatively related.

Keywords : Capital Regulation, Risk-Based Capital, Portfolio Risk, Basel I, Moral Hazard, and Thai Commercial Banks

I. INTRODUCTION

Banks signify for economic development. They mobilize saving to allocate financial supplies in support of investment capital enhancing an economy's innovation, growth, and the distribution of income whereas their adverse impacts can cause damages to depositors, and financial stability. A function of financial intermediary emerges due to imperfection of information in financial market. Therefore, information asymmetry plays an important role to theoretically explain moral hazard problem in banking business. Investors and shareholders, as principals, have limited in knowledge of financial market while a bank manager, as an agent, attempts to maximize his own utility through the principles' value maximization from risky portfolio investment. The arisen moral hazard problem may cause market failures.

The moral hazard problem raises concerns among policy makers to put their emphases on maintenance of economic growth and financial stability that depend on banking system's safety and soundness. The main objective of banking regulation is to protect depositors' losses from bank failures caused by excessive risk taking which leads to capital insolvency. To prevent insolvent banks, Bank for International Settlements (BIS) was institutionalized by G-7 countries. Its mission is to strengthen and promote prudential standards of banking capitalization to those economies. BIS issued the first Basel capital accord in 1988, so called "Basel I", as a guideline for the international supervisors to regulate commercial banks' capital to cover risk assets such as bad loans, and highly-returned investments. However, debates among theorists and practitioners have centered whether or not the standard enhances an increase in capital, and effectively controls excessive risk taking. The standard, on the one hand, should compel banks to increase their net worth that strengthens solvency position, financial safety, and soundness. On the other hand, the standards induce bank to increase capital leading to higher leverage. This allows banks to take excessive risk portfolios of asset and investment. These intended and unintended effects are ambiguous among theoretical and empirical studies.

This study aims to empirically investigate the impact of regulatory capital standard of Basel I on Thai commercial banks' capital and portfolio risk. A cross section data of 18 Thai commercial banks during the 2002-2008 on a quarterly basis is estimated by the simultaneous equations developed by

Shrieves and Dahl (1992). As this topic has never studied for Thai commercial banks, this paper investigates how the banks adjust their risk-weighted capital, i.e., BIS ratios and risk portfolios which cover credit and market exposures following the Basel I regulatory capital standard.

The rest of this study is organized as follows. Section II reviews the rationale of bank's capital and portfolio risk relationship including a broad range of cross country empirical studies. Section III explains panel data of Thai commercial and model specification. Section IV discusses the empirical results of estimation. Section V provides conclusion and remarks.

II. REVIEW OF LITERATURE

A financial intermediary maximizes its value by maintaining optimal leverage and risk under conditions of incomplete financial markets and imperfect information. Banks as depository financial intermediaries issue claims i.e. deposits against themselves and use the proceeds to purchase other financial assets such as loans and investment (Pyle, 1971; Hart and Jaffee, 1974). Scholars have analyzed and synthesized theory of financial intermediaries based on risks and returns of the modern portfolio approach. They have explained financial intermediations employing the mean-variance approach and option pricing models. According to information asymmetry and moral hazard problems, depositors do not have sufficient information on the banking activities for monitoring purpose. They assess banks' asset and investment risks with limited information while the managers have better information and understand their portfolio risks. Hence, information asymmetry explains that the depositors' ability of monitoring and screening banks is weak and they cannot distinguish a safe and sound bank from other risk-taking banks.

Moral hazard problem arises as the bank managers have incentive to maximize profit and dividend for shareholders and have information advantage. They usually utilize banks' capital and debt to purchase risky assets and securities, and investment projects which yield higher returns. This return-maximization behavior incurs risk, and harmfully affects losses of debtors, particularly small depositors. However, the owners' losses are limited by a small number of their equity stocks investments. Problems of moral hazard and information asymmetry in banking industry lead to existence of regulatory public policy to control banks' capital and insure depositors' losses. Regulators

mainly aim to preserve banking solvency which is explained by the relation between equity, debt, and asset riskiness (Dewatripont and Tirole, 1999).

In the literature, the main justification for regulating bank capital lies on moral hazard problem. The inefficiently missed pricing of deposit insurance regime induces bank to expose riskier assets. The theoretical aim for bank capital regulation is to reduce moral hazard problem from the deposit insurance scheme in the sense that stockholder is enforced to share losses.

Pyle (1971), and Hart and Jaffee (1974) apply portfolio management approach that a bank makes choice of portfolio investments between assets and liabilities. Particularly, loans and deposits are treated as risky securities. Assuming competitive markets and explicit risks of default and rates of return, a bank manager, viewed as a portfolio manager, maximizes expected returns by making decision on investments which affect loans and deposits. Koehn and Santomero (1980) investigate the role of bank capital regulation in risk control as a result of banks' portfolio selection with high risk due to inefficiently priced deposit insurance. The mean-variance analysis is reexamined the portfolio behavior of commercial banks comparatively with and without capital ratio regulation. They summarize that although regulatory capital constraints are designed to protect depositors and lower the probability of bank failure in banking system, the result will perhaps be oppositely different from the regulatory intent as the higher requirements are imposed. The regulation is suggested to impose on both asset composition and capital. Kim and Santomero (1988) explore the new risk-related capital plan in controlling bank risk. The derivation of theoretical correct risk weights leads to the conclusion that the use of simple regulatory capital ratios is ineffective. They suggest that optimal portfolio choice of commercial banks be changed by explicit calculation of risk weights under the risk-based capital plan and restrictions of risk weights on asset composition. Rochet (1992) supports Koehn and Santomero (1980) and Kim and Santomero (1988), and concludes that under the incompleteness of financial market and utility-maximizing portfolio model, the correct risk weights capital ratio become crucial. He suggests the adoption of market-based risk weights into capital ratio calculation.

The option-pricing model has a proposition of moral hazard problem that bank shareholders' value of equity can be maximized by a bank manager. He or she maximizes returns with minifying

capital and increasing risk under the deposit insurance subsidy scheme. The literature based on option pricing framework argues that the magnitude of incentives to increase bank leverage and risk correlates with the levels of leverage and asset risk (Merton, 1977; and Stolz, 2007). Furlong and Keeley (1989) assess the impact of changes in capital ratio requirements on a bank's incentive for increasing asset risk with comparative analyses of a state-preference models and options model. The state-preference model suggests that the more stringent capital regulation reduce the risk exposure of the deposit insurance system. For the option pricing model, they find similar result as others. Keeley and Furlong (1990) compare the option model to the portfolio theory, and summarize that the utility-maximization framework has been mischaracterized the bank's investment opportunity set by neglecting the option value of deposit insurance. Their finding reconfirms that more stringent capital regulation decreases incentives for a value-maximizing bank to increase risk assets.

2.1. Bank Capital and Risk in Developed Economies and Cross Country Studies

The theoretical literature is separated by the two strands of whether the regulatory capital requirement affects banks' capitalization accumulation or produces portfolio risk exposures. Empirical studies in developed, developing, and cross countries show different results and conclusions.

A. U.S. Market

Peltzman (1970) originally models the commercial bank capital investment as a function of adjustment processes of capital to expected deposits with other determinants such as expected rate of return, and a ratio of U.S. government bond as a measure of portfolio risk. The effect of capital regulation is included in the investment model. The study finds no regulatory effect on bank capital, which is the same as in Dietrich and James (1983). On the contrary, Mingo (1975) replicates the original study using the same specification of model and regression with employment of different bank level data. The effect of regulation on bank capital investment is statistically significant.

These aforementioned works are prototype of later studies in a way of using partial adjustment framework. Partial adjustment framework assumes that banks target to set optimal levels of capital. As external factors affect actual capital levels shifting away from

the optimal levels, banks will partially adjust capital to fulfill the targeted levels instead of full adjustments which may be costly and/or infeasible. The partial adjustment framework assumes that the adjustment is proportional to the difference between optimal and actual levels of capital.

Shrieves and Dahl (1992) empirically study on the impact of the relationship between changes in risk and capital. The study attempts to determine the association between adjustments to risk and capital. The statistical evidence shows a positive relationship between changes in risk and capital. The finding suggests that banks with capital ratios above the level of regulatory minimum requirement, owners' and/or managers' private incentives tend to mitigate risk exposure. For banks with capital ratios below the regulatory minimum standard, the result indicates the partial effectiveness of regulation on changes in risk and capital. According to empirical analyses on the panel data, they conclude that changes in capital are risk-based behavior. Similarly, Jacques, and Nigro (1997) incorporate variables of risk-based capital standards that reflect the degree of regulatory pressure. They find that the risk-based capital standards have significant increases in capital ratios and decreases in portfolio risk in the commercial banks.

In addition, as Federal Insurance Corporation Improvement Act (FDICIA) became effective in December 1992, regulators have had legitimacy measures to close insolvent banks, and to intervene problem banks at the early stage, so called, Prompt Corrective Action (PCA) focusing on triggers of capital ratios. Aggarwal and Jacques (1998) assess the impact of the PCA regulation on bank capital ratios and portfolio risk level. The results indicates the effectiveness of FDICIA that both adequately capitalized and undercapitalized banks increase their leverage capital ratios in response to PCA due to the fact the former tended to meet the requirements because they are faced with the possibility of regulation sanction while the latter may have decreased risk to reduce the probability of a significant reduction in their capital ratios resulting from an exogenous shock. U.S. banks increase their capital ratio without offsetting increase in credit risk. The authors conclude that PCA is successful in raising capital ratios without unintended effect of increasing risk.

B. Non U.S. Developed Markets and Cross-Country Studies

Ediz, Michael, and Perraudin (1998) study the impact of capital

requirements on British bank behavior. They conclude that regulatory capital seems to affect bank behavior over and above the influence of the banks' own internally generated capital targets. In addition, banks appear to achieve adjustments in their capital ratios primarily by directly boosting their capital rather than through systematic substitution away from high risk assets such as corporate loans. The evidence supports that regulatory capital is a prudential instrument to enhance stability of the banking system without apparently distorting bank's lending choices.

Rime (2000) finds that regulatory pressure tend to increase the ratio of capital to risk-weighted assets in Swiss banks where the ratios are closely above to the minimum requirements. The regulatory pressure also has a significantly positive impact on the ratio of capital to assets but does not alter the banks' risk level. The study finds no significant relationship between changes in risk and changes in the ratio of capital to risk-weighted assets that are consistent with a regime of Basel I, as capital-constrained banks would have to adjust their capital to total assets ratios before an increase in risk in order to maintain the ratio of capital to risk-weighted assets constant.

Heid, Porath, and Stolz (2003), and Stolz (2007) assess German savings banks, and find that the coordination of capital and risk adjustments is dependent on the amount of capital held exceeding the minimum requirement. They conclude that banks with low capital buffers attempt to adjust an appropriate capital buffer by raising capital and simultaneously lowering risk whereas those with high capital buffers try to maintain their capital buffer by increasing risk when capital increases. Kleff and Weber (2004) agree that German saving; cooperative; and commercial banks aim to maintain their buffer capital because of potential regulatory costs. The study finds the positive significance effect of portfolio risk on the capital ratio among moderately capitalized banks for all three groups but the evidence for less capitalized banks showed that the positive relationship diminishes or even turns negative as these banks increase capital and decrease portfolio risk to rebuild their capital buffer.

Roy (2003) investigates the impact of Basel I on banks' capital, and risk in six G-10 countries. The study distinguishes the effects of regulatory capital requirements and ma`rket pressure on changes in capital and credit risk. The results suggest that market pressure plays

a dominant role on capital increases because there are no different rates adjustment of capital ratios at weakly-capitalized banks and well-capitalized banks in five non-U.S. countries. He finds that only U.S. weakly-capitalized banks increase their capital ratios faster than well-capitalized banks. The findings indicate that adjustment rates of risk-weighted assets are indifferent in U.S. and non U.S. weakly-capitalized banks and well-capitalized banks.

Matejasak, and Teply (2007) support that regulatory requirements affect U.S. and European banks' behavior. Both U.S. and European banks which hold capital closer to minimum requirements simultaneously increase their capital. In addition, the U.S. banks decrease their portfolio risk taking. The empirical evidence shows that the European banks are cautious to maintain their capital on a safe level. Their findings support the proponent of positive relationship between capital and risk level adjustments whereas there is no unintended effect of regulatory capital requirement on probability of bank default.

2.2. Bank Capital and Risk in Developing Countries and Cross Country Studies

Nachane, Narain, Ghosh, and Sahoo (2000) assess the impact of Prompt Corrective Action (PCA) regulation on changes in bank capital ratios and risk in a bank's portfolio in India based on the research of Jacques and Nigro (15). The statistical results suggest that adequately and well-capitalized banks significantly decrease their capital ratios as well as their risk portfolio when pressured by the regulation. The findings show that changes in capital and risk are negatively related.

Murinde and Yaseen (2004) assess the impact of Basel I on banks' capital and risk in the Middle East and North African (MENA) region. The study finds that the capital requirements have significant effect on banks' capital ratio decisions and that regulatory pressure does not induce banks to increase their capital, but it does positively affect their chosen risk level.

Hussain, and Hassan (2006) focus their attention on the impact of Basel I capital requirement regulations on commercial banks' credit risk taking in 11 developing countries around the world. The results indicate that Basel I capital requirement regulations has not increased banks capital ratios in the developing countries but such regulations decrease banks' portfolio risk. The evidence also shows that the level of financial development and credit risk

are inversely related. This implies that financial sector development brings about alternative sources of funds which results reduction in risk. The study recommends that policy formulation and implementation for developing countries be concerned about institutional environments in different countries.

Bouri, and Hmida (2006) find some responses in the Tunisian context that the capital regime has exceptional effects on capital and risk. Indeed, the regulatory constraint affects banking provisions and the capital level more than the solvency ratio. The estimation presents that dynamic and multidimensional results of the relationship between the capital and risk variations reflect a change of the observed banks behaviors. They increase their capital as well as the risks due to the regulation.

III. SAMPLE DESCRIPTION AND MODEL SPECIFICATION

This study employs data from Thai commercial banks' financial statements covering items of banks' balance sheet and profit and loss on a quarterly basis during the period of 2004Q1 to 2008Q3. Of 18 existing commercial banks, 13 banks are fully licensed commercial banks; 4 banks are retail commercial banks; and only 1 bank is licensed as a subsidiary bank. Therefore, the panel data counts on 294 observations which descriptive statistics and correlation matrix appear in Table 1 and Table 2, respectively.

This study hypothesizes that the regulatory capital requirement will reduce banks' moral hazard and will enforce them to increase their capital. The relationship between the standard and risk taking variables is expected to be negative while the banks capital is anticipated to positively relate to the regulatory policy variable.

As same as in the literature, the relationship between bank capital and portfolio risk, and the impact of risk-based capital standards on both capital and risk will be examined by a simultaneous equations model with partial adjustment developed by Shrieves and Dahl (1992). In their model, observed changes in banks' capital and credit risk ratios are decomposed into two components: 1) a discretionary adjustment; and 2) a change caused by factors exogenous to the bank:

$$\Delta CAP_{j,t} = \Delta^d CAP_{j,t} + E_{j,t} \quad \ldots(1)$$

$$\Delta RISK_{j,t} = \Delta^d RISK_{j,t} + U_{j,t} \quad \ldots(2)$$

where $\Delta CAP_{j,t}$ and $\Delta RISK_{j,t}$ are the observed changes in capital and risk ratios, respectively, for bank j in period t. The $\Delta^d CAP_{j,t}$ and $\Delta^d RISK_{j,t}$ variables represent

discretionary adjustments in capital and risk levels, and $E_{j,t}$ and $U_{j,t}$ are exogenously-determined factors.

According to (1), discretionary changes in capital and risk are applied with a partial adjustment framework:

$$\Delta^d CAP_{j,t}=\alpha(CAP^*_{j,t}-CAP_{j,t-1}), \quad ...(3)$$

$$\Delta^d RISK_{j,t}=\beta(RISK^*_{j,t}-RISK_{j,t-1}). \quad ...(4)$$

where $CAP^*_{j,t}$ and $RISK^*_{j,t}$ are the target capital and risk ratios, respectively. Thus, the discretionary changes in capital and risk for bank j are proportional to the difference between the target ratio and the observed ratio in period t-1.

Substituting equations (3) and (4) into equations (1) and (2), the changes in capital and risk can be written as:

$$\Delta CAP_{j,t}=\alpha(CAP^*_{j,t}-CAP_{j,t-1})+E_{j,t}, \quad ...(5)$$

$$\Delta RISK_{j,t}=\beta(RISK^*_{j,t}-RISK_{j,t-1})+U_{j,t}, \quad ...(6)$$

Therefore, observed changes in capital and risk in period t are a function of the target capital and risk ratios, the lagged capital and risk ratios, and any random shocks.

The partial adjustment model postulates that the target capital and risk ratios of a bank be not observable. The literature recommended that the ratios be assumedly dependent on some set of observable variables describing the bank's financial condition and the state of the economy in each country. The empirical literature explains that those variables have been approximated for the target capital ratio, $(CAP^*_{j,t})$ and the target risk ratio, $(RISK^*_{j,t})$.

This study measures $CAP_{j,t}$ as the ratio of total capital to total risk weighted assets according to Basel I and $RISK_{j,t}$ as the ratio of to risk weighted assets to total assets. The target capital ratio includes: asset size $(SIZE)$ which is transformed into the model as the natural log form (Aggarwal and Jacques, 2001; Roy, 2003; and Hussain and Hassan, 2006); liquidity risk (LIQ) hich is measured by the ratios of liquid reserves to total assets (Hussain and Hassan, 2006); return on assets (ROA) that is the ratio of net profit to total assets (Heid et al., 2003; Roy, 2003; and Hussain and Hassan, 2006); loan losses reserves (LLR) that is constructed as the ratio of new net provisions to total assets (Rime, 2000; Heid et al., 2003; Roy, 2003; and Hussain and Hassan, 2006). The target risk ratio has a similar set of these variables. Hence, the model specification appears as follows:

$$\Delta CAP_{j,t}=\alpha_0+\alpha_1 SIZE_{j,t}+\alpha_2 LIQ_{j,t}+\alpha_3 ROA_{j,t}+\alpha_4 LLR_{j,t}+\alpha_5 REG_{j,t}+\alpha_6 CAP_{j,t-1}+\alpha_7 \Delta RISK_{j,t}+u_{j,t} \quad ...(7)$$

$$\Delta RISK_{j,t}=\beta_0+\beta_1 SIZE_{j,t}+\beta_2 LIQ_{j,t}+\beta_3 LLR_{j,t}+\beta_4 \mathrm{REG}_{j,t}+\beta_5 RISK_{j,t}+\beta_6 \Delta CAP_{j,t-1}+w_{j,t} \quad ...(8)$$

As $E_{j,t}$ and $U_{j,t}$ are exogenously-determined factors, they are the main emphasis variables apparent in the literature and this study. The focus is on the regulatory capital requirements $(REG_{j,t})$ that state agencies, namely, central banks or financial services authorities compel their regulated firms in the function of stability maintenance. The literature presents a set of variety of regulatory pressure variables. This study compares regulatory pressures in 3 ways of dummy variables: 1) the PCA measures, namely, PCAU which is unity for banks with BIS ratio less than 8.5%, and zero otherwise, and PCAA which is unity for banks with BIS ratio between 8.5% and 9.5%, and zero otherwise (Aggarwal and Jacques, 1998; and Rime, 2000); 2) advanced PCA approach, RPL which equals the difference between the inverse of a bank's total risk-based capital ratio, and the inverse of the regulatory minimum risk-based ratio for all banks with a total risk-based capital ratio less than 8.5%, and zero for all banks with risk-based ratios above the minimum, and RPG which equals the difference between the inverse of the regulatory minimum risk-based ratio, and the inverse of a bank's total risk-based capital ratio for all banks with a total risk-based capital ratio greater than or equal 8.5%, and zero for all banks with risk-based ratios below the minimum (Jacques and Nigro, 1997; and Murinde and Yaseen, 2004); and 3) a probabilistic approach of regulatory pressure that reflected the impact of the capital ratio's volatility on the probability of failing to meet the legal requirements, namely, REG which equals the sum of the 8.5% BIS ratio, and a bank standard deviation of risk-based capital ratio greater than a bank total risk-based capital ratio, zero otherwise (Ediz et al., 1998; and Rime, 2000).

This study estimates the model using instrumental variables approaches, Three-Stage Least Square (3SLS) and Generalized Method of Moments (GMM). As the partial adjustment model comprises of endogenous variables, and lagged dependent variables, 3SLS recognizes the endogeneity of both capital and risk in the simultaneous equations model, and produces asymptotically efficient estimated parameters. GMM estimator, that assumes no autocorrelation in the error term $U_{j,t}$ and uses lagged difference of dependent variables as instruments, is also employed to obtain unbiased estimates and increase asymptotically efficiency. As 3SLS and GMM yield quite similar estimates of the sample, this paper rather presents results of GMM which is more efficient.

IV. RESULTS OF ESTIMATES

Table 3 presents the GMM results of estimating equation (7) and (8) with the 3 approaches of regulatory dummy. The Sargan tests for over-identification restrictions are satisfied with the j-statistics. The first order autocorrelations in the residual are tested with AR (1) that the coefficients are statistically significant. This study rather emphasizes on simultaneous estimates in the advanced PCA approach which yield the best statistical fit and robustness for the interpretation of policy implication. In the capital equation, asset size *(SIZE)* has a significantly negative impact on $\Delta CAP_{j,t}$ indicating that large banks main tain lower capital since they can easily access to capital funds. Return on assets *(ROA)* has a significantly positive impact on $\Delta CAP_{j,t}$, indicating that banks with high profitability increase their capital through retain earnings. As expected by the literature, the relationship between $\Delta CAP_{j,t}$ and loan losses reserves ratio *(LLR)* is positive, showing that banks need more capital as they face with higher credit risk and probability of losses but the variable is not statistically significant. The liquidity reserve ratio *(LIQ)* should have indicated a negative impact on capital since higher liquid banks normally face with less risk, need lower capitalizations but it has an opposite sign and is not statistically significant impact on capital. The argument here is that liquidity measurements appeared in the literature may not be appropriated whereas Thai commercial banks are largely funded by deposits. RPG is positive and statistically significant supporting that the capital regulation has intended effect on adequately, and well capitalized banks to lift up their capitalizations. However, RPL is negative and statistically significant implying that the regulation may not effectively influence under-capitalized banks to increase capital. This may need more stringent capital supervision on those banks rather than normal regulation. The explanatory power of RPG is much higher than that of RPL implying that adequately, and well-capitalized banks adjust their capitalizations more responsive than under-capitalized banks.

For the risk equation, RPG and RPL are negative and statistically significant explaining that the capital regulation influences all bank to lower their risk exposures. It is worth noting that the coefficient of RPL in the risk equation is one fold larger than that of the capital equation indicating that under capitalized banks are more likely to reduce risk than unintended reduction of capital. LIQ is negative but statistically significant contrasting to the literature

that the argument can be explained as the aforementioned capital equation. $SIZE$ and LLR show positive signs as expected but not significant. The advanced PCA system also indicates the significantly negative relationship between changes in capital $\Delta CAP_{j,t}$ and risk portfolios $\Delta RISK_{j,t}$ of Thai commercial banks.

V. CONCLUSIONS AND REMARKS

Although the results of estimates from three approaches of regulatory dummies are mixed and difficult to conclude, they are similar as found in the previous literature. According to the advanced PCA approach (Jacques and Nigro, 1997), this study concludes that the capital regulation exerts intended effects on adjustments of capital and risk among adequately capitalized banks while it has unintended effects on under capitalized banks. This study also finds the negative relationship between changes in capital and risk portfolios of Thai commercial banks. Understanding of risk taking behavior of Thai commercial banks under Basel I standard leads to development of Basel II implementation. Future study should make attempt to study the relationship between banks' charter values and capital and risk.

Table 1 Descriptive Statistics for the Pooled Sample of 294 Observations

Statistics	CAP	RISK	SIZE	LIQ	ROA	LLR	PCAU	PCAA	REG	RPG	RPL
Mean	17.0921	68.0115	12.3682	13.5350	0.8893	5.0676	0.0238	0.0408	0.2313	0.0471	0.0027
Median	14.1343	69.1071	12.5121	11.8012	1.2565	4.4970	0.0000	0.0000	0.0000	0.0469	0.0000
Maximum	166.5103	100.0912	14.3064	69.4583	3.9300	16.4769	1.0000	1.0000	1.0000	0.1116	0.5916
Minimum	1.4073	24.4604	7.7062	1.3525	11.2000	0.1350	0.0000	0.0000	0.0000	0.0000	0.0000
Std. Dev.	13.3350	13.7246	1.4993	7.9885	2.1191	2.9752	0.1527	0.1982	0.4224	0.0226	0.0349
Skewness	6.6270	-0.3184	-0.8889	2.2000	-3.1143	0.7185	6.2470	4.6414	1.2745	0.3100	16.4499
Kurtosis	64.4287	3.5704	3.2269	13.0194	15.4582	3.1846	40.0244	22.5426	2.6244	3.1090	277.6071

Table 2 Correlation Matrix

	CAP	RISK	SIZE	LIQ	ROA	LLR	PCAU	PCAA	REG	RPG	RPL
CAP	1.0000										
RISK	-0.0860	1.0000									
SIZE	-0.5680	0.0134	1.0000								
LIQ	0.4967	-0.5565	-0.3546	1.0000							
ROA	-0.3560	0.3721	0.3824	-0.4659	1.0000						
LLR	-0.1486	-0.0213	0.3207	-0.1860	0.1716	1.0000					
PCAU	-0.1314	-0.1458	-0.0080	0.1382	-0.1687	0.0776	1.0000				
PPAU	-0.1249	-0.1085	0.0932	-0.0363	-0.0547	0.1756	-0.0322	1.0000			
REG	-0.2391	-0.1155	0.0214	-0.0245	-0.2456	-0.0157	0.2847	0.3761	1.0000		
RPG	0.7086	0.1210	-0.5435	0.2665	-0.0492	-0.1134	-0.3263	-0.3685	-0.5553	1.0000	
RPL	-0.0848	-0.0606	-0.0062	0.0848	-0.1338	0.0600	0.5015	-0.0162	0.1428	-0.1636	1.0000

Table 3 The System Generalized Method of Moments (GMM) Estimates: Impacts of Regulatory Pressures, 2004Q1-2008Q3

Dependent Variables	Approaches					
	PCA		Capital Volatility		Advanced PCA	
	ΔCAP	ΔRISK	ΔCAP	ΔRISK	ΔCAP	ΔRISK
Regressors / (Expected Signs in ΔCAP and ΔRISK Equations)						
C	10.0875***	7.3216***	28.5202***	8.5155***	4.0341***	10.1333***
	(3.13)	(2.93)	(4.80)	(3.61)	(3.02)	(3.99)
SIZE (- / -)	-0.5528***	0.0583	-1.3621***	-0.0105	-0.2654***	-0.1975
	(2.42)	(0.39)	(3.15)	(0.07)	(2.68)	(1.26)
LIQ (- / +)	0.0254	-0.1199***	0.0058	-0.1237***	0.0299	-0.0951***
	(0.82)	(3.34)	(0.12)	(3.68)	(1.29)	(2.76)
ROA (+ / nil)	0.2779		0.2561		0.3945**	
	(1.31)		(1.25)		(2.57)	
LLR (+ / -)	0.0528	-0.0269	-0.0187	-0.0803	0.0648	-0.0228
	(0.68)	(0.31)	(0.11)	(1.01)	(1.22)	(0.28)
CAP(-1)	-0.2567***		-0.7215***		-0.3847***	
	(5.62)		(11.90)		(19.67)	
RISK(-1)		-0.0929***		-0.0900***		-0.0753***
		(5.55)		(5.57)		(4.07)
ΔRISK	0.0269		-0.0234		-0.2089**	
	(0.84)		(1.20)		(2.45)	
ΔCAP		-0.5114***		-0.3568***		-0.5545***
		(5.35)		(4.55)		(6.90)
PCAU	-5.0633***	-2.5977***				
	(5.26)	(2.85)				
PCAA	-1.1758***	2.1092**				
	(2.63)	(2.27)				
REG			-3.1933***	0.1424		
			(5.27)	(0.37)		
RPL					-5.3672***	-10.2631***
					(4.24)	(4.39)
RPG					88.4582***	-19.5598*
					(8.99)	(1.66)
AR(1)	0.3715***	-0.2538***	0.7717***	-0.3174***		-0.2838***
	(4.54)	(3.36)	(21.82)	(4.37)		(3.71)
Adjusted R-squared	0.5892	0.3471	0.6392	0.3011	0.8415	0.3421
Durbin-Watson stat	2.2859	2.0267	2.0381	1.8193	1.7646	1.9833
Determinant residual covariance	101.1130		92.1142		55.1468	
Sargan / J-statistic	44.3793 / 0.1644		26.3545 / 0.0915‰		21.2089 / 0.0736‰	

Note: The dependent variables are CAP (the ratio of total capital to total risk weighted assets), and RISK (the ratio of risk weighted assets to total assets). SIZE is defined as the natural log form of total assets. LIQ is measured by the ratios of liquid reserves to total assets. ROA is return on assets that is the ratio of net profit to total assets. LLR refers to loan losses reserves defined as the ratio of loan provisions to total assets. PCAU, PCAA, REG, RPL, and RPG are dummies for regulatory pressures testing. AR (1) indicates the test for the first-order autocorrelation in the residuals. J-statistics refer to the Hansen test of over-identifying restrictions. The absolute t-values, in a two-tailed t-test, are given in parentheses; *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

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