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DISCUSSION PAPER

Developing the Efficient and Resilient Financial System for Thailand: Lessons from the Crisis and Challenge Ahead

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*The views expressed in this paper are those of the authors
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Abstract

The purpose of this paper is to discuss and raise important policy implications from the U.S. crisis in the Thai context, so as to contribute to the appropriate and forward-looking policy design for the Thai financial. Issues discussed in this study involve: (i) financial linkages and systemic risk assessment; (ii) procyclicality of the financial system; (iii) appropriate regulatory arrangement, bank governance and executive compensation. Regarding the systemic risk issue, we found evidence of negative externalities imposed onto the banking system value-at-risk (VaR) by banks and other types of financial institutions such as finance, securities and insurance companies. Therefore, bank regulators needs to be aware of the additional risk imposed onto the system during distress time and take this into account when assessing the risk level of banks. Next, the results from panel data regressions suggested that the level of procyclicality decreased from the pre-Asian Crisis period when compared to the post-crisis period. Moreover, the nature of cyclicality differed by asset classes. Therefore, we proposed that, if their goal was to mitigate excessive cyclicality, supervisors must also take into account types of loans as well. Finally, the paper outlines the importance of implementing regulatory statues that will minimize regulatory arbitrage as well as promoting cautious financial innovations and bank governance, which were identified as a few of the fundamental causes leading to the onset of the U.S. financial crisis.

Finding the right a balance between stability and efficiency in financial system development has always been a challenge to policy makers, central bankers and bank supervisors, since both components are needed to construct the perfect financial system. This challenge has proved to be increasingly difficult, especially in the last few decades, and for both emerging and developed countries alike, as can be seen by the occurrence of several pervasive and severe of financial crises. Furthermore, this task is made even more challenging due to the constantly evolving financial landscape and innovations.

In light of this recent financial crisis aftermath, the goal of our paper is to first identify key regulatory weaknesses experienced from this U.S. financial crisis that are most relevant in the Thai context. Next, we attempt to provide in-depth analyses and discussions, as well as offering policy options and putting forward the remaining challenges on issues addressed in our study. After evaluating all the causes of the recent crisis and their relevance to the Thai financial system, we hence chose to examine the following issues: (i) financial linkage and systemic risk assessment; (ii) procyclicality of the financial system; and (iii) appropriate regulatory arrangement, bank governance and bank executive compensation.

Regarding the financial linkage and systemic risk assessment, we first studied the causes of systemic risk in the financial system. Then, we presented the existing international and the Bank of Thailand's regulations that could help mitigate such systemic risk. Next, we presented the results on the quantification of the level of financial linkages and systemic risk in the Thai financial market, which is the forthcoming research of Roengpitya and Rungcharoenkitkul (2009). The authors found evidence of additional risk imposed by banks onto the system during the distress time. In addition, using post-crisis data, finance companies and insurance companies seemed to contribute to the system VaR during the stress time in a different fashion than banks. Finally, we offered policy options and discussing remaining challenges to conclude the section.

As for the issue of procyclicality, we first investigated the mechanism and financial transmissions contributing to the procyclicality nature of the financial system. Mainly we concentrated on the possible current regulatory statues that may have contributed to procyclicality in the system. With the current regulatory environment analysis, we then endeavored to quantify the

extent of procyclicality in Thailand. We found evidence of a decrease in the level of procyclicality after the Asian crisis, when compared to the period prior to the crisis. Moreover, we also discovered evidence that the nature of procyclicality was different depending on asset classes. Finally, we also proposed policy options and addressed remaining challenges involved the procyclicality issue.

As for the appropriate regulatory arrangement, bank governance and executive compensation, we discussed how one should approach financial innovations, as a part of financial liberalization. We also expressed how to minimize regulatory arbitrage through the consolidated supervision framework and how to mitigate regulatory cycle. Last but not least, we also addressed the importance of enhancing bank governance as well as the brief up-to-date discussion on the structure of bank executive compensation currently raised by leading international supervisors.

The paper is divided into four main parts. The first part outlines the regulatory weaknesses arisen from the current financial crisis and their relevance to the Thai financial system. The detailed analysis of the financial linkages and systemic risk is presented in the second section. The third part addresses the causes of procyclicality and the quantification of its level in Thailand. The fourth section consists of discussions on on the appropriate regulatory arrangement and on the improvement of bank governance along with the executive payment structure. The concluding remarks and the appendix conclude the paper.

I. REGULATORY WEAKNESS FROM THE CURRENT CRISIS

The dynamic of the onset of this current U.S. financial crisis can be summarized as follows. First, it started with low or negative real interest rates in the major economies and a glut of savings centered in East Asia and the Middle East. These have resulted in capital inflows into some countries in order to seek high yield investments by investors. As a result, asset prices, especially housing markets, began to rise up steadily. This overheating market contributed to the market instability through two channels. First, it led to the lax credit underwriting standard, especially on the no-income no-job or assets (NINJA) obligors whose ability to repay and creditworthiness might have been severely underestimated (Eee and Xiong (2008)).

Second, increasing asset prices, together with innovative financial products particularly mortgage-related derivatives, played a key role in encouraging a build-up of leverage and risk-taking behavior among both regulated and unregulated entities. However, when the financial environment turned bad, this excessive level of risk and leverage resulted in heavy losses, followed by a rush to unwind leverage, which was made difficult due to the inability to price the assets fairly because of the underestimation of risk associated with the newly-invented derivatives (Benmelech and Dlugosz (2009), Kregel (2008) and Rodriguez (2008)). This risk-taking behavior was evident, as can be seen from a correlation between credit growth, asset prices, and the real economy (Goodhart, 2004).

Unwinding such imbalances finally led to market freeze and liquidity crisis when some institutions were unable to price their assets, especially on their complex derivative holdings. It is worth noting that an important factor contributing to the loss of liquidity in fixed-income markets during early 2008 was the sudden refusal of lenders in the repo market to accept as collateral the same wide range of assets as before. This made it extremely difficult for asset holders to price the instruments, and also led to a sharp worsening of the liquidity profile of institutions, such as Bear Stearns who had a large quantity of these assets on their balance sheets (Cohen and Remolona (2008)). At this point, liquidity crisis was inevitable and it only took one institution's liquidity shortage to start the panic in the financial market.

Given this knowledge about how the crisis unfolded, it can be seen that there are still regulation-related areas which need improving. Some examples of how regulatory weaknesses had contributed to the onset of this crisis are as follows. First, the implementation of Basel I Capital Accord encouraged banks to shift risky securitized activities off-balance sheet since it allowed banks to reduce the capital and transparency associated with a given risk profile (Eichengreen (2008)). This point was improved in Basel II where banks are required to hold capital for the securitization items on their off-balance sheets via the application of credit conversion factors (CCFs). Second, there was an issue regarding "regulatory arbitrage," where a financial entity aims at taking advantage of differences in supervisory requirements between regulated and less-regulated financial entities. This contributed to the onset of the crisis where the less-regulated institutions, such as investment banks, found it beneficial to take risk without the consequences of having to hold sufficient capital for it.

Third, the current regulation might have amplified the volatility of credit growth during the upswing and downswing of the business cycle—the behavior known as "procyclicality" of the financial system. This is because some policies regarding risk measurement and provision, as well as accounting standards, depend on the current-period evaluation of risk and capital buffer. This procyclicality of credit growth was identified as one of the important causes of the crisis. Fourth, there is also a century-old question of whether sequential bank failures could have been prevented and systemic risk minimized in the first place. Fifth, many economists conjectured that the true underlying risk of complex derivatives could have been addressed should vital information became more transparent to investors. Investors could therefore make a decision based on more complete information (Eichengreen (2008)). Finally, there is also an issue of an incentive misalignment between bank management taking risk and actually bearing the consequences of it (Cohen and Remolona (2008)). This issue of how bank executives should be motivated to govern and should also be compensated, especially on making the compensation to be more long-term risk-adjusted pay-performance-based, is being discussed widely in the banking industry and policy makers, following this recent crisis. In addition, the bank governance framework now should include more accountability and involvement of the management on the bank's risk appetite and risk-taking strategies.

These issues will become critical for Thailand in the near future because, with the implementation of the Financial Sector Master Plan II (FSMP II), an increase in competition may lead to more financial innovations and banks seeking to raise more profit. The result of this will be the emergence of new and more complex financial products launching into the market so as to serve an increase in customer demands. Financial institutions will also be more connected through their lines of businesses. The dispersion of risks from innovations across the financial system can, therefore, increase the instability of the system as well as the economy.

With these regulatory weakness issues in mind, we have narrowed the focus of our study onto four main categories—(i) financial linkages and systemic risk assessment; (ii) procyclicality of the financial system; and (iii) the importance of appropriate regulatory arrangement and bank governance. We will explore each of these issues in depth in the next three main sections.

II. UNDERSTANDING FINANCIAL INSTITUTION LINKAGES AND SYSTEMIC RISK

The recent financial crisis gave rise to the crucial question—whether the spread of the crisis could have been minimized—and much attention has been given to the issues regarding financial linkages and systemic risk. Even though Thai banks were spared from the direct impact of the crisis this time, investigating the nature of financial linkages and systemic risk remains crucial to policy makers, as the Thai financial market is evolving toward a more competitive and interconnected financial environment. Therefore, this section of the paper aims at providing some answers to these issues. The first section summarizes current causes and studies of financial linkages and systemic risk. Then, Section 2 addresses the current bank legislation that plays a role regarding both financial linkages and systemic risk. Section 3 presents the estimates of the level of financial linkages and systemic risk in the Thai financial system. Section 4, which contains the outline of available policy tools to mitigate different kinds of risk as well as remaining challenges, concludes this topic.

1. CURRENT DISCUSSIONS ON FINANCIAL LINKAGES AND SYSTEMIC RISK

In light of the recent financial crisis, regulators are now focusing more attention on constructing a framework that will enhance further financial stability. According to the Bank of International Settlements (BIS), this framework consists of two types of analyses—cross-sectional and cross-time (BIS 79th Annual Report). The source of instability across time, which arises from the behavior of agents in response to the business cycle, will be address in the next section regarding the "procyclicality" of the financial system. The cross-sectional analysis of financial instability regards the issues of financial linkages between institutions and, more importantly, the identification of the sources of systemic risk. The sources of systemic risk can be classified into three types: (i) from *instruments* such as loans, bonds, equities and derivative instruments; (ii) from *markets* such as bilateral over-the-counter (OTC) trading in the markets; and (iii) from *institutions* such as banks, securities dealers, insurance companies, etc. Our study will focus the attention on the last source of

risk—institutions, although systemic risk caused by institution linkages closely ties to the instruments these institutions employ and markets they trade.[1]

Numerous literatures have addressed the importance and identified possible causes and consequences of financial linkages and systemic risk. Generally, there are a few ways one can define the term "systemic risk" in the banking industry.[2] In this paper, we defined the term "systemic risk" as the probability that, if one institution is in distress, it can possibly trigger other institutions to also be in distress, which can consequently lead to bank run and the collapse of the financial system when a certain number of institutions are affected.

In order to understand the importance of financial linkage and systemic risk measurement as well as policies involved in mitigating such risk, one needs to first investigate why systemic risk exists and becomes very important in the financial system in the first place. The following sections outline a few types of theoretical models and insights that help shed some light onto the existence of systemic risk.

1.1 BANKS' ATTEMPT TO REDUCE AGGREGATE RISK LEADS TO MORE SYSTEMIC RISK

The main idea of this theory relies on the observation that there are aggregate risks which cannot be diversified away[3] embedded within the financial system itself and the attempt by banks to pass on these risks leads to an increase in systemic risk. In the past, banking crises usually happened in conjunction with macroeconomic shocks, namely interest rate and exchange rate risks, which by

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[1] As noted in Chapter 1 of Brunnermeier, et al. (2009), banks and other financial intermediaries involve in trade among themselves than corporates do via interbank and derivative markets as well as brokerage services.

[2] Kaufman and Scott (2003) summarized three possible definitions of "systemic risk" in the banking industry. First, it is "an event having effects on the entire banking, financial, or economic system, rather than just one or a few institutions." (Bartholomew and Whalen (1995)). Second, systemic risk is the "risk of a chain reaction of falling interconnected dominos." (Kaufman (1995)). The third definition of systemic risk focuses on the similarities in third-party risk exposures among the institutions involved.

[3] Usually, there are two types of risks classified in a single market or system. One is called "idiosyncratic risk" which is the risk imposed on a specific institution and not others and therefore can be viewed as a random shock to an institution. Because of this quality, idiosyncratic risk can be diversified or transferred to another party which can bear more risk (i.e. being more 'risk neutral'). A simple example is buying auto insurance where the buyer transfers the buyer-specific risk to the insurance company. Another type of risk is called "aggregate risk" which is the type of risk by which every party in the market is affected and therefore cannot be transferred to the other party since everyone will be exposed to this same risk. An example of this "aggregate risk" will be the H1N1 virus which affects everyone equally and therefore one cannot be insured against being infected by it.

nature is the aggregate risk and consequently is not diversifiable (Hellwig 1995, 1997, 1998). The only way the banking industry will be able to reduce this is to limit its exposure to aggregate risk or to pass the risk onto the third party, mainly depositors (Hellwig (1995) and Staub (1998)). However, this mechanism of passing on the risk to depositors is inefficient since depositors can withdraw money at any time, regardless of the macroeconomic environment and therefore the shocks. This non-contingent nature of deposit contracts pushes banks to try other means possible to limit the exposure to these aggregate shocks.

Since shifting the risks to depositors is inefficient, banks try to reduce this macroeconomic risk in other ways. For example, banks may try to limit the interest rate risk by using derivative contracts, such as swaps, to transfer the risk to the third party. However, these derivative instruments carry additional counterparty risk, creating the default-dependent contracts. The contracts that are highly relevant to these types of hidden risk are OTC derivatives and money market transactions, which are off-balance-sheet items (Staub (1998)). Hence, the reduced interest rate risk comes back to banks in the form of counterparty or default risk (Hellwig (1997) and Staub (1998)). As a bank enters these contracts with the third party that also has similar contracts with other banks, the interconnection between financial institutions is established and thus systemic risk increases when one counterparty defaults. Therefore, an attempt to mitigate aggregate shocks does lead banks to be exposed to more systemic risk.

1.2 THE CAPITAL STRUCTURE OF BANKS MAY LEAD TO THE "COLLECTIVE RISK SHIFTING" WHICH INCREASES SYSTEMIC RISK

In corporate finance, capital structure can substantially affect the risk taking behavior. Under the debt-financing capital structure and the limited liability condition, the owner of the firm has an incentive to take more risk since, in the event of bankruptcy, all debts are forgiven after all the assets have been liquidated and the debt holder redemption has been executed as best as possible (Milgrom and Roberts 1992). The implication of this theory is particularly strong for banks, which are highly-leveraged institutions. Acharya (2001) examined this risk shifting incentive in the banking industry. In his theoretical model, he demonstrated that banks shifted the risk in such a way that they invested

into correlated assets and therefore took too much risk after having taken into account the interest of depositors and the social cost coming from the financial distress. Therefore, the interconnection between banks in his model stems from the correlation of bank assets. Moreover, Acharya also showed that, if there were strong negative effects[4] from a bank's failure upon one or more banks, banks would be induced to invest in the same industry, so as to survive or fail together—the strategy which he called *collective risk taking*. The consequence of this strategy is that banks will hold assets that will be even more highly correlated which leads to a higher probability of the joint bank failure. Therefore, Acharya's model demonstrates that systemic risk in the banking industry is a part of an incentive problem[5] regarding the collective risk taking strategy of banks.

1.3 COORDINATION PROBLEM, DOMINO EFFECT AND LIQUIDITY SHORTAGE

Another realm of literatures reasons that systemic risk simply is a problem of coordination and this is usually the version of the systemic risk explanation one is accustomed to. The spread of bank failure through the interconnection of institutions may come from the coordination failure during the confidence and liquidity crises. In theory, if the credit market is perfect, then an illiquid but solvent bank will be able to raise fund at any time because of its solvency status. However, in practice this is not the case. When the coordination between banks fails during liquidity shortage, a solvent bank will not be able to raise funds as it wishes. In the recent crisis, for example, Bear Sterns's capital was adequate throughout the period of mid March 2008 but its liquidity level went from more than $18.1 billion on March 10th to less than $2 billion on March 13th.[6] Therefore, when banks refuse to lend to other banks (even if that bank is solvent) during confidence and liquidity

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[4] Acharya (2001) called this negative effects "negative externalities," on which its magnitude depends on the size of the failing bank, the uniqueness of the failing bank, as well as the case where the surviving banks do not benefit from taking over the facilities of the failing bank.

[5] Another related incentive issue that leads to systemic risk deals with the liquidity management. Rochet and Tirole (1996) studied the interbank market and liquidity management. They found that the misalignment of incentives between bank managers and depositors led to banks taking more risky projects and the problem was made worse when the projects were subjected to random liquidity shocks. Although this incentive misalignment can be alleviated using the interbank market where lending banks monitor the risk taking behavior of borrowing banks, if not monitored properly, the default of one institution can trigger series of defaults in other institutions because short-term liquidity management in interbank markets leads to a large amount of uncollateralized exposures.

[6] SEC Chairman Christopher Cox's letter to Basel Committee in support of New Guidance on Liquidity Management. http://www.sec.gov/news/press/2008/2008-48.htm.

crises, the interbank and short-term repo markets freeze and consequently trigger series of liquidity shortage and panic in the financial system.[7] Although this coordination problem has been in existence with banking crises in the past, the severity of this problem escalated particularly during this recent crisis. On his remark regarding the failure of Bear Sterns, the Federal Reserve Chairman Ben Bernanke gave the following statement, "Until recently, short-term repos had always been regarded as virtually risk-free instruments and thus largely immune to the type of rollover or withdrawal risks associated with short-term unsecured obligations. In March, rapidly unfolding events demonstrated that even repo markets could be severely disrupted when investors believe they might need to sell the underlying collateral in illiquid markets."[8] The lesson learned from Bear Sterns is that, when there is a crisis of confidence among counterparties, fellow banks or financial institutions can be unwilling to make even secure funding available to those who are in serious need of liquidity, leading to market freeze and consequently the spread of liquidity crisis to other institutions. Therefore, the systemic risk caused by liquidity shortage in the financial system has been made more severe in this latest financial crisis.[9]

2. CURRENT BANK LEGISLATION REGARDING SYSTEMIC RISK ISSUES

Since regulating financial institutions is crucial in internalizing externalities caused by contagion bank failures,[10] this section examines the current regulatory statues regarding financial linkages and systemic risk—the issues that have gained so much momentum particularly after this recent crisis. With this in mind, it is worthwhile to examine whether the current regulatory standards, both internationally and those implemented by the Bank of Thailand (BOT), have taken into account

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[7] In Chapter 2 of Brunnermeier, et al. (2009), the authors reasoned that confidence crisis does not have to originate from the counterparty default risk but may arise from an asset price spiral that deteriorates the asset value of financial institutions' balance sheets as well as the loss spiral that was reinforced by margin/haircut effects.

[8] Chairman Ben Bernanke's speech at the Federal Reserve Bank of Atlanta Financial Markets Conference, May 13, 2008. http://www.federalreserve.gov/newsevents/speech/bernanke20080513.htm.

[9] For more on the studies regarding solvency and liquidity, Diamond and Dybvig (1983) Bank Run Model provided a theoretical analysis of how panic to withdraw could have led to bank failure. Freixas and Rochet (1997) examined the reasons why solvent banks could not raise liquidity in practice.

[10] Schwarcz (2008) mentioned that the externalities caused by systemic risk came from the fact that financial market participants are motivated to protect themselves and not the system and Cifuentes et al. (2004) stated that banks would protect themselves but not the stability of the banking system, even when banks could collectively prevent systemic risk.

and can possibly help mitigate the spread of financial risk between institutions as well as the risk in the system overall.

2.1 THE INTERNATIONAL REGULATORY STANDARD

To date, both Basel I and Basel II standards have yet to deal with the issue of systemic risk specifically. However, the Basel Committee on Banking Supervision (BCBS) issued first in 2008 *Principles for Sound Liquidity Risk Management and Supervision*, followed by the consultative document *Proposed Enhancements to Basel II Framework*, which was approved recently on July 9th, 2009. These documents in part address the importance of acknowledging the correlation between institutions and having better liquidity management to prevent the spread of the crisis. For the 2008 *Principle for Sound Liquidity Risk Management and Supervision,* the idea is to expand upon the original *Sound Practices for Managing Liquidity in Banking Organizations* issued in 2000 in the areas yet to be considered following the U.S. crisis. The updated issues regard the importance of governance of liquidity risk management, measurement and management of liquidity risk, public disclosure, as well as roles of supervisors. On the issue of governance, banks should articulate a liquidity risk tolerance and craft the strategy, policies and practice to match such tolerance along with internalizing associated liquidity costs into its pricing framework. The measurement and management policies outlined in the paper stress the importance of "identifying, measuring, monitoring and controlling liquidity risk," by managing well the liquidity exposures and positions, funding needs, conducting stress testing and having a contingency plan. In addition, BCBS is working on the minimum global liquidity standard such as establishing liquidity coverage ratio, metrics for liquidity supervision and cooperation of home and host supervisors of cross border banking groups.

The proposals to improve Basel II's Pillar I in the *Proposed Enhancements to Basel II Framework* deal with taking more conservative approaches toward the parameters used in estimating the risk-weighted assets of securitized products. In the context of liquidity management, the related proposals involve: (i) adjusting the credit conversion factor (CCF) for unrated liquidity facilities so that they no longer be sensitive to short-term maturity; and (ii) discontinuing the special treatment on the CCF for liquidity facilities under the general market disruption case and using the regular liquidity

CCF. As for Pillar II adjustments, BCBS recommended the following changes to be made: (i) bank executives should consider the interconnection of risks between business lines and should enhance the risk management framework to cover all types of risks; (ii) the bank's stress testing scenarios and internal capital adequacy assessment process (ICAAP) should also cover the liquidity risk and must have a contingency plan for the case of a liquidity crisis; (iii) risk management must take into account the asset correlation or concentration that may lead to additional market, credit and liquidity risk as well as other types of risk from off-balance sheet items not currently covered under Pillar I (such as interest rate risk in banking book-IRRBB) and also from bank's reputation and implicit support.

2.2 THE BANK OF THAILAND'S REGULATORY FRAMEWORK ON SYSTEMIC RISK

The bank supervision policies implemented by the BOT have been based on the concept of forward-looking and risk-based regulatory framework for years. Regarding the issue of systemic risk, the current regulation is yet to specifically deal with systemic risk. However, some current regulations help play a role in mitigating the contagion and systemic risk at different levels of financial entities—from the by-institution level to the inter-institution level and finally at the system-wide level. At an institution level, the current regulatory statue aims at enhancing the risk assessment and capital holding of banks to cover different types of risk banks take. Starting at the end of 2008, any Thai commercial bank must have sufficient capital cushion under Basel II's Pillar I to cover credit risk, market risk and operation risk, where this capital adequacy ratio (CAR) must be at least 8.5 percent of the total risk-weighted assets (RWA) of a specific bank and at least 4.25 percent of Tier 1 capital to its RWA. In addition, foreign bank branches must hold at least 7.5 percent of its RWA and must also hold capital under Section 32. Such capital requirement becomes the first line of defense against bank run in critical times, as capital cushion is supposed to cover the unexpected loss of banks and be used as a tool for crisis prevention and risk mitigation. Also based upon this CAR requirement are the principles of prompt preventive action (PPA) and prompt corrective action (PCA). PPA will be imposed on banks whose CAR is between 8.5-9.5 percent and banks will be subjected to a thorough investigation on its risk, management and integrity of business conduct. Then, the bank must submit a clear action plan which will be evaluated on a quarterly basis. As for the PCA, the

authority is granted to the BOT under Section 97 of the current regulatory statue. The possible

actions include the suspension of certain or all businesses and recapitalization requirement for a bank

whose CAR falls below 8.5 percent but is not lower than 5.5 percent. If the CAR is between 2.5-5

percent, then the BOT will either intervene or initiate mergers with other banks. Finally, if CAR is

below 2.5 percent, then the bank must be closed.

Since the first domino to fall and trigger the contagion effect usually involves a bank with bad

liquidity management and with insufficient or no stress testing plan to handle a crisis situation, the

Bank of Thailand also evaluates banks during the annual examination on their liquidity management

ability and their stress testing scenarios, in addition to the overall capital requirements. The liquidity

management evaluation is based on the BOT's guideline regarding liquidity management of financial

institutions, issued in September 2002, which considers different aspects of liquidity management,

ranging from the involvement of the bank management and internal control, as well as the level of

compliance to the BOT liquidity regulations, to ensuring that the bank has sufficient liquidity cushion

on top of the availability and credibility of a contingent plan if the bank is to be faced with a liquidity

crisis. Regarding the specific liquidity regulations, a bank is first subjected to the liquidity reserve

requirement where the bank must hold the proportion of so-called "assets that are considered liquid,"

computed on average every 14 days, as follows:

$$\frac{\text{required liquid asset amount}_t}{(\text{total deposits} + \text{other liabilities determined by the Bank of Thailand})_{t-1}} \geq 6\%,$$

with some additional specifications on how the numerator and denominator are calculated.[11] Next, the

bank must have available upon request its Maturity Gap Report to the BOT as a part of its liquidity

assessment. The Report consists of breaking down components of assets and liabilities and assessing

their maturity gap at each level of a maturity date in order to calculate for the net liquidity position.

This approach has just been suggested by a group of experts led by Brunnermeier, et al. (2009). This

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[11] The components of liquid assets must consist of at least 0.8% of the denominator as bank's current account deposits at the BOT on average and no more than 0.2% of the denominator as cash deposited at the cash center of a commercial bank on average. In addition, the sum of the amount of deposits at the BOT and at the bank's central cash unit must be at least 1% of the required liquid asset amount and any excess amount of the sum shall only be counted toward the required asset amount only if the sum does not exceed 2.5% of the total required amount. As for the denominator, the bank must include all deposits, short-term foreign borrowing which may be subjected to recall within one year from the borrowing date, and the total borrowing under structured notes.

maturity gap assessment helps banks to be aware their liquidity risk level as well as their liquid and illiquid assets and sources of fund.

The purpose of stress testing is to help financial institutions evaluate their risk tolerance ability should a low-probability but high-impact event is to occur. Under such circumstance, the capital cushion estimated using normal scenarios will not be sufficient to cover the loss during the stress time. Making financial institutions aware of their possible risk positions during such time can prevent them from being the first domino to fall and trigger the contagion effect. Therefore, in a context of systemic risk prevention, a bank must also assess its liquidity position during the crisis time through the requirement concerning the bank's stress testing methodology. According to the September 2002 liquidity management guideline, the bank's stress testing strategy must include its assessment of the net liquidity position in the next seven days if the crisis were to happen today, using "bottom-up" scenario analyses which take into account the past actual behavioral maturity.[12] The institution-based scenarios should reflect well the circumstances of liquidity risk sources arisen from the ill management which can possibly lead to instability and consequently the loss of confidence by depositors and creditors of that bank. At present, the stress testing assignment will be evaluated during the annual bank onsite examination. In addition, banks must also conduct stress testing on the "top-down" scenarios determined by the BOT (started in June 2008). For instance, the scenarios in 2008 considered the effects of economic slowdown, an increase in NPL leading to losses in asset values, and possible consequences of implementing a deposit insurance ceiling.

As for the legislations to mitigate the risk at an inter-institution level, there are two groups of regulations which can mitigate it. The first group aims at reducing the risk from the commitments of a bank's counterparties while the second group targets the liquidity risk that can affect a bank from other banks being in trouble. Since the counterparty risk is regarded as one of the main causes of systemic risk discussed previously, the BOT has implemented a set of regulations to dampen it. First, for the off-balance sheet items that carry possible counterparty default risk, the implementation of

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[12] "Bottom up" scenarios are contemplated and tested by an individual bank and the BOT will evaluate both on the credibility of the scenarios as well as the results of the stress test. Another type of stress testing is the "top down" scenarios where banks will be assigned the scenarios by the BOT to test their risk position. In the BOT regulation context, the "top down" is often referred to as "Macro Stress Test" since the scenarios assigned by the BOT take into account the macro events that affect all financial institutions simultaneously.

Basel II since the end of 2008 forced banks to provide capital for the securitized items by means of the CCFs stated in the previous section. Also, until recently, any bank who wishes to enter into a complex derivative commitment, other than plain vanilla or the specified set of derivatives satisfying the BOT check-list, must seek the BOT's approval prior to executing the agreement with its counterparty.[13] Following this regulation means that bank executives and management involved in such commitment will have to know the risk of that particular derivative contract and have to provide a contingent plan in case the bank's counterparty defaults. In addition, starting in June 2009, banks will need to hold capital for the cross-currency and other trading contracts yet-to-be executed based on a contract's maturity and exposure in case the counterparty fails to meet the obligation. This new regulation is called the "fail-trade agreement" requirement. The idea of this statue is to have banks provide a cushion which is more risk-sensitive for the cases where there are uncertainties in the settlement of commitments between banks. This requirement will not only alleviate the counterparty default risk but also help reduce settlement risk in bilateral or multi-lateral netting arrangements, which become the possible sources of bank instability, especially for the forward-dated contracts in foreign exchange, derivative and other cross-border markets (Eisenbeis (1997)).[14] The second group of regulation deals with liquidity risk from financial linkages via the stress testing requirement. Stated in the September 2002 liquidity management guideline, banks must conduct the "bottom-up" analyses of its liquidity risk in the event of a contagion bank run, where deposits are transferred from a less-trustworthy bank to a more secured bank.

Finally, at the system level, in addition to the goal of ensuring macroeconomic stability, the Bank of Thailand also entails banks to conduct the liquidity stress testing based on systemic risk scenarios. In this case, banks must include in their possible crisis scenarios the event of severe macroeconomic shocks, both originated from within the country and internationally, and the analyses

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[13] The criteria used in granting the permission include, for example, the risk management ability of the bank, the effect such derivative contracts will have on macroeconomic environment, commitment to allow monitoring by BOT and client suitability analysis. For more details, please see Section III. Until recently, the BOT has relaxed some of its regulation on derivative products so as to allow banks more hedging ability.

[14] The famous case for the settlement risk happened in 1974 when German's Herstatt Bank failed to meet its mark-for-dollar exchange agreements because of the difference in settlement time. Herstatt Bank was therefore closed by German authorities.

of consequences following these shocks, especially on the bank itself if all banks are to be affected simultaneously.

2.3 SYSTEMIC RISK-RELATED REGULATION-WHAT IS COMING UP

Apart from the regulations already in place, there are a few additional requirements to be implemented by the Bank of Thailand that can further help with inter-institution and systemic risk within the next few years. By the end of 2010, the regulation regarding Basel II's Pillar II will be implemented. The Pillar II framework will concentrate on the evaluation of the Internal Capital Adequacy Assessment Process (ICAAP) of banks, which can potentially lead to additional capital holding if BOT feels that the bank may not possess sufficient capital to cover the current risk. The bank's ICAAP framework should cover risks not covered under the current Pillar I, such as interest rate on banking book, credit concentration and reputation risk, as well as liquidity risk. In addition, the framework must include the stress testing on credit concentration risk (annually) market risk and liquidity risk (quarterly). Incorporating the interest rate on banking book will directly impact the calculation of the regulatory capital for market risk and, as a result, will internalize partly the externalities of banks' behavior to decrease aggregate shock exposure, such as interest rate risk by means of issuing derivative contracts mentioned in Section 1.1. Taking into account an additional impact of loan concentration on credit risk helps address the possible danger coming from having a too-high asset correlation within a bank's portfolio, which may be coming from the bank taking a specific business strategy. In addition, the concentration risk information can help bank supervisors in assessing the possible *collective risk shifting* strategy previously mentioned in Section 1.2 and thus can detect early the possible sequential bank failures. Finally the implementation of additional liquidity stress test requirements helps strengthen the existing liquidity management framework that will prevent systemic risk originated from the coordination and liquidity problems mentioned in Section 1.3. Within this legislation, liquidity stress test now must include extreme but plausible stress scenarios with the forward-looking stress periods of 1, 7, 14 and 30 days.

3. SYSTEMIC RISK QUANTIFICATION IN THE THAI FINANCIAL SYSTEM

After investigating the causes and existing systemic risk-related regulations, we next present the results from Roengpitya and Rungcharoenkitkul (2009), whose research attempted to quantify the degree of financial linkage during the trouble time and the level of systemic risk present during the distress time. This quantification is the first of its kind to be done for the Thai financial system.

As a matter of fact, a few models have been introduced in order to assess the degree of financial linkages and systemic risk by using the credit default swap (CDS) data (as detailed in the appendix). Even though these models provide an important assessment on the relationship among financial institutions via credit risk channels, they may have left out the inter-institution connections through other types of risk such as market, operation or liquidity. Because of this reason and the fact that the CDS data for Thai financial institutions is extremely scarce, the method used in Roengpitya and Rungcharoenkitkul (2009) followed the techniques used by Adrian and Brunnermeier (2008).

In their study, Adrian and Brunnermeier (2008) used the estimation of the change in normalized market-valued total assets as a measurement for an institution's and the system's value-at-risk (VaR). The market-valued total asset data is extracted from the stock market performance of financial institutions listed in Bloomberg. The employment of such stock market data was also shared by De Nicolo and Kwast (2001) who measured the systemic risk potential by using the correlation of stock returns. The idea behind Adrian and Brunnermeier (2008) is that, if the stock market is efficient, then the price of stock of a financial institution and consequently its total asset value should reflect the net effect of all types of risk associated with that institution put together. This provides an advantage of capturing all possible aspects or risk emphasized by Chairman Yutaka Yamaguchi of the Committee on the Global Financial System, "Systemic problems develop as market risk, liquidity risk and credit risk factors interact with each other in a complex manner. This means that any evaluation of systemic risk based on one isolated factor could only provide a fragmentary view. What is called for is the "triangular view of systemic risk"—comprehensive analysis covering the interactions or nexus between the banking system, financial markets and the real economy."[15] The authors then used

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[15] Chairman Yutaka Yamaguchi's speech at the Third Conference on Risk Measurement and Systemic Risk (2002). http://www.bis.org/cgfs/conf/mar02h.pdf.

the estimated VaR to quantify the additional system risk generated by a financial institution if that institution were to be in distress. This measurement reflects the "negative externalities" of a financial institution, as it captures the measurement of additional negative effects left out if regulators were to consider only the stand-alone VaR when assessing the riskiness of a financial institution.

Therefore, this Section 3 will outline the concepts used by Adrian and Brunnermeier (2008). Then, the primary systemic risk quantification results within the banking industry as well as within the financial system itself will follow. Finally, the estimation of financial linkages of banks through evaluating the impact that one institution has on the other concludes this section.

3.1 HOW TO ASSESS SYSTMIC RISK IN THE THAI FIANANCIAL SYSTEM

Contrary to the conventional method used in measuring systemic risk, Adrian and Brunnermeier (2008) concentrated on computing the negative externalities, namely additional risk in the system not captured by considering just the system VaR alone, instead of evaluating the systemic risk itself. The authors argued that there must be additional stress imposed onto the system by institutions during the crisis time and therefore considering only the institution's VaR or the system VaR should be deemed insufficient. Their analysis can be elaborated by the following example.

Figure 1: Concept of Externalities
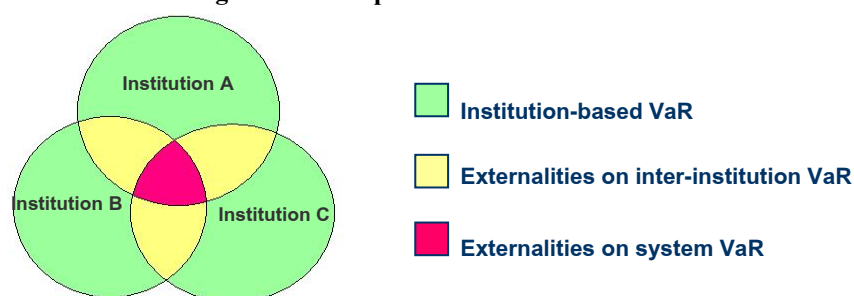
Let's assume that the existing financial system consists of three institutions—Institutions A, B and C. In general, regulators and managements of these market participants may consider only the institution's VaR (the green area). However, there are externalities both parties may have overlooked if they only care about the institution-based VaR. The yellow area represents the inter-institution externalities which come from an increase in Institution A's VaR if Institution B were to be in distress. Similarly, the red area displays the externalities imposed onto the system if, say, Institution

A were to be in distress. Therefore, the quantification developed by Adrian and Brunnermeier (2008) provides a more complete picture of the true VaR in the financial system.

In order to measure such externalities, one needs to first estimate the VaR both at an institution level and at a system-wide level. The best approximation of the changes in total assets of an institution yields the VaR estimates at an institution level. Then, the summation of all institutions' VaR gives the VaR of the financial system itself. The next step is to measure the impact of an institution in distress on the other institution's VaR and on the market VaR. Such impact measurement is called the "CoVaR," which can be computed with respect to both at the institution level and the market level.
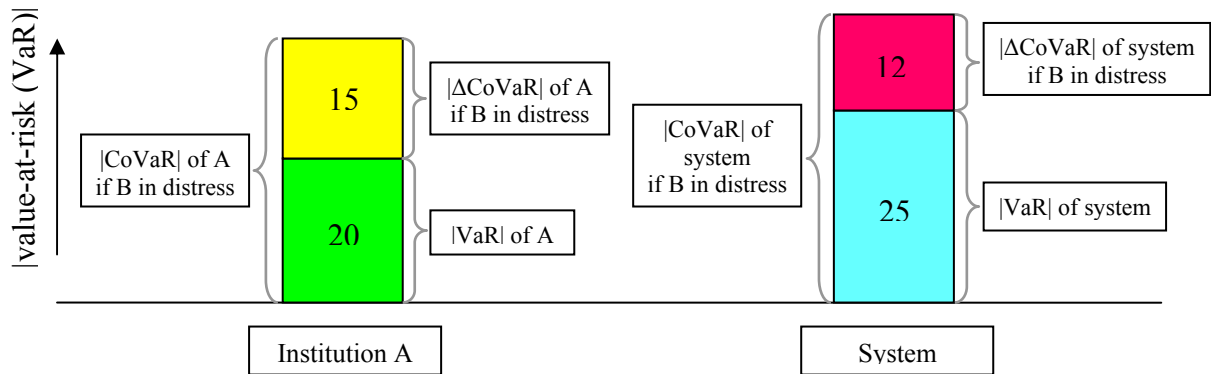
Figure 2: CoVaR and ΔCoVaR Definitions

Figure 2 demonstrates how the "CoVaR" is calculated. Each column represents the absolute value of the VaR of either an institution or the system itself. Specifically for this Section 3.1, the VaR is represented in an absolute value to show its impact, since the VaR is usually a negative number. Therefore, the higher the column is, the riskier an institution or the market becomes. Institution A, for example, has a stand-alone institution VaR equal to 20 units (the green area). If Institution B is in distress, then it creates 35 units of the VaR of Institution A, which is the "CoVaR" of Institution A if Institution B is in trouble (CoVaR(A|B)). The net effect of the Institution A's VaR increase from Institution B is called the "ΔCoVaR(A|B)," which is equivalent to the yellow area of 15 units (equal to CoVaR(A|B)-VaR(A)=35-20 units). Following this similar analysis, we have that VaR(system) is 25 units and the impact of Institution B being in distress on the system VaR, CoVaR(system|B), stands at 37 units. The net effect of Institution B's contribution to the system VaR if it is in distress, ΔCoVaR(system|B), is therefore equal to 12 units (the red area).

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So, the next question is, what are the negative externalities previously mentioned? The negative externalities of Institution A from Institution B being in distress are the same as "ΔCoVaR(A|B)." This is because ΔCoVaR(A|B) represents the excess amount of Institution A's VaR, apart from the stand-alone VaR of Institution A, caused by Institution B. This measurement reflects negative externalities when one only considers the VaR of Institution A alone. These inter-institution externalities are equivalent to the yellow area in Figure 1. Similarly, ΔCoVaR(system|B) is the excess amount of system VaR caused by Institution B if it is in distress on top of the current level of system VaR itself. Therefore, ΔCoVaR(system|B) captures the negative externalities of Institution B on the system risk apart from looking at the system VaR alone.

The estimation of "ΔCoVaR" can also be used as a relative measurement tool when it comes to determining which financial institution causes more disturbances than others. For example, if |ΔCoVaR(A|B)|>|ΔCoVaR(A|C)|, then one can make a good inference that, since Institution B's impact is more than Institution C's impact on Institution A, then Institution A should be more financially-linked to Institution B than C in crisis time. In addition, if |ΔCoVaR(system|A)| is greater than |ΔCoVaR(system|B)|, then one may conclude that, if Institution A is in distress, it produces more negative externalities to the system than Institution B. Adrian and Brunnermeier (2008) suggested that the level of regulations toward financial institutions should be set, in a tailor-made way, according to the degree of negative externalities generated by an institution onto the system VaR.

3.2 THE QUANTIFICATION OF SYSTEMIC RISK IN THE THAI BANKING SYSTEM

In their paper, Roengpitya and Rungcharoenkitkul (2009) employed the weekly stock market data of financial institutions obtained from Bloomberg for their assessment of the "ΔCoVaR" calculation. They divided their analysis into two parts. First, they considered using bank data only, which is equivalent to looking at systemic risk within the banking industry as a stand-alone system. For this analysis, they employed the weekly stock market data of six Thai commercial banks during the 1996Q2-2009Q1 period, covering the Asian crisis phase, to estimate the ΔCoVaR within the banking industry. Their second set of analysis involved estimating ΔCoVaR for the financial system as a whole, including other non-bank financial institutions such as finance and securities companies as

well as insurance companies. The details on the econometric concepts and methods of the estimated results are listed in the appendix.

For the estimation of ΔCoVaR for the stand-alone banking industry during 1996-2009, the authors found evidence of negative externalities imposed onto the system by the Thai commercial banks in their study.[16] Recall from Section 3.1 that the VaR is the best estimated value of the change in total assets of either an institution or the market, Figure 3 presents the actual change in total assets in the banking system and its best estimated value which is the banking system VaR. From the figure, it can be seen that during the Asian crisis, the volatility of total asset change (blue line) was much higher than other periods. Also, the VaR of the system during the years 2003-2006 became less negative when compared to other periods, reflecting the so-called 'good period' of the Thai economy, and the system VaR exhibited more negative values during the recent financial crisis, starting in 2007. The banking system exhibited the highest risk (through high negative VaR values) toward the end of 2008, when the economy started entering the downturn phase and was faced with political instability.

Figure 3: Change in Total Assets vs. Estimated VaR
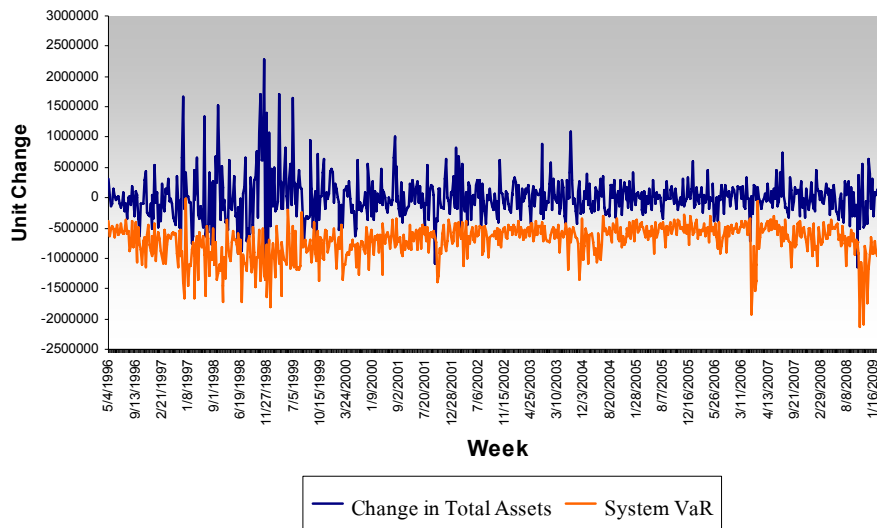
Source: Roengpitya and Rungcharoenkitkul (2009)

Because the authors used the 99-percent quantile regression as the method of choice in estimating ΔCoVaR, they were interested in estimating the ΔCoVaR when the system was stressed to be at its 99-percent risk level, which happened on December 5th, 2008, and assessing which institution

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[16] It is also important to note that their results are still very preliminary. Future improvements on the estimations may lead to different results and estimates.

created more negative externalities on that date. Figure 4 showed the estimated ΔCoVaR versus the stand-alone institution VaR for that specific date. [17]

Figure 4: Bank VaR vs. Bank's ΔCoVaR
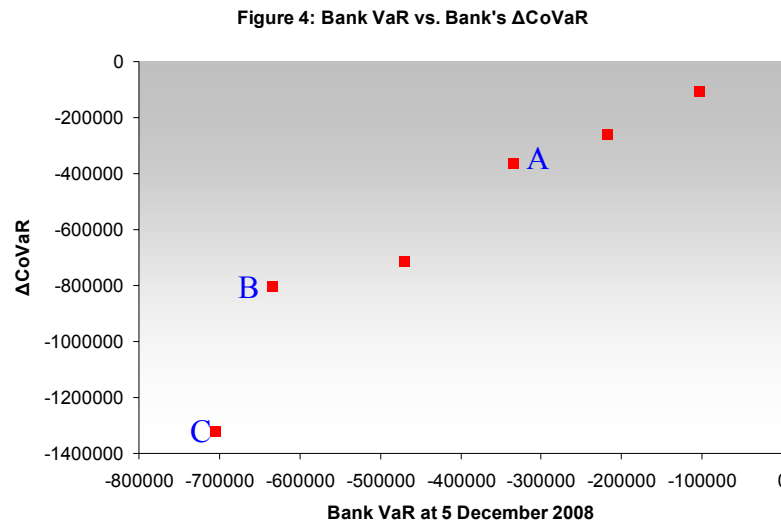
Source: Roengpitya and Rungcharoenkitkul (2009)

From Figure 4, all banks did generate negative externalities toward the system risk on December 5th, as can be seen from the negative ΔCoVaR value at this date. These banks were different not only on their VaR level but also on the level of negative externalities imposed onto the system. For instance, Bank A had the stand-alone VaR equal to -336,000 units with about -362,000 units of negative externalities compared to Bank B which had -635,000 units of VaR and about -800,000 units of externalities. To compare between these two banks, Bank A imposed the additional risk of about 1.07 times its stand-alone VaR onto the system, while Bank B produced about 1.25 times its VaR as externalities. Hence, per unit of an institution's VaR, Bank B contributed more to the system risk than Bank A. The worst case scenario was somebody like Bank C, which created about -1,321,000 units of negative externalities which, at its stand-alone VaR level of -706,000 units, are equivalent to about 187 percent of its own VaR (or 1.87 times its VaR level).

In addition, if the snapshot was taken on December 18th, 1998 (which corresponds to the system being at its 99.5-percent stress level) during the aftermath of the Asian crisis, there was also similar evidence of negative externalities, as measured by ΔCoVaR, imposed onto the system by all commercial banks, as shown in Figure 5.

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[17] Recall that ΔCoVaR is defined as CoVaR(system|A)-VaR(system) and, since CoVaR and VaR are usually negative numbers, if this difference is negative, that means the CoVaR is greater than the VaR of the system itself, thereby justifies the concept of negative externalities.

Figure 5: Bank VaR and ΔCoVaR
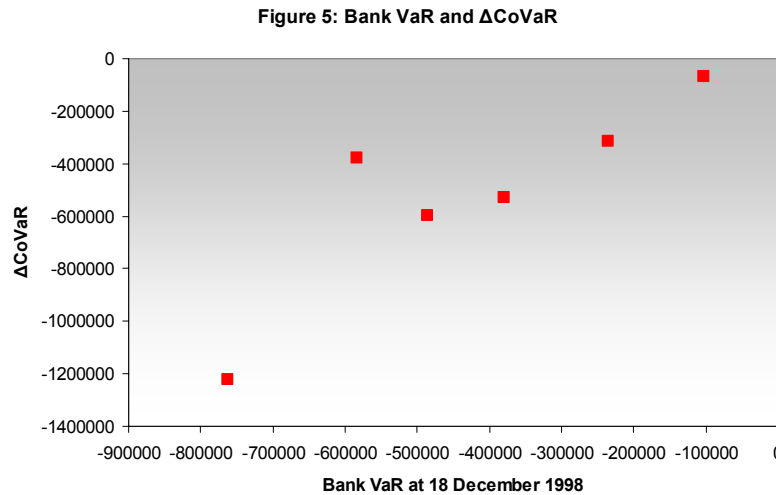
Source: Roengpitya and Rungcharoenkitkul (2009)

The lesson to be drawn here is that it is insufficient to consider only the stand-alone institution VaR for the purpose of mitigating systemic risk. Looking at the institution VaR alone will be very much misleading, since there are externalities not captured by considering only the stand-alone institution VaR, especially for the case like Bank C whose size of the additional contribution to the system VaR was very large. Hence, these externalities should be internalized, or at least taken into consideration, when it comes to thinking about assessing the riskiness of banks, which should cover all possible types of risk that can affect the banking system as a whole.

3.3 THE QUANTIFICATION OF SYSTEMIC RISK IN THE THAI FINANCIAL SYSTEM

In the second part of their analysis, Roengpitya and Rungcharoenkitkul (2009) dealt with the estimation of ΔCoVaR for the financial system as a whole, including other non-bank financial institutions such as finance and securities companies as well as insurance companies. Because of the limited availability of data, to get the complete weekly stock market profile for all the institutions in consideration (six Thai commercial banks, six securities and finance companies and seven insurance companies), the authors were able to use the data from the period of 2000Q2-2009Q1. Figure 6 presents the actual change in total assets in the financial system and its best estimated value which is the financial system VaR during the time period used in the estimation.

From Figure 6, it can be seen that the impact of the recent U.S. financial crisis was very much present in the Thai financial system. The VaR became more negative at the end of 2008 when

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compared to 2007, as the news about the negative impact of the U.S. Crisis affected Thailand via the report of Q4 GDP forecast along with the closure of the airport at the end of 2008.

Figure 6: Change in Financial Assets vs. System VaR

Source: Roengpitya and Rungcharoenkitkul (2009)
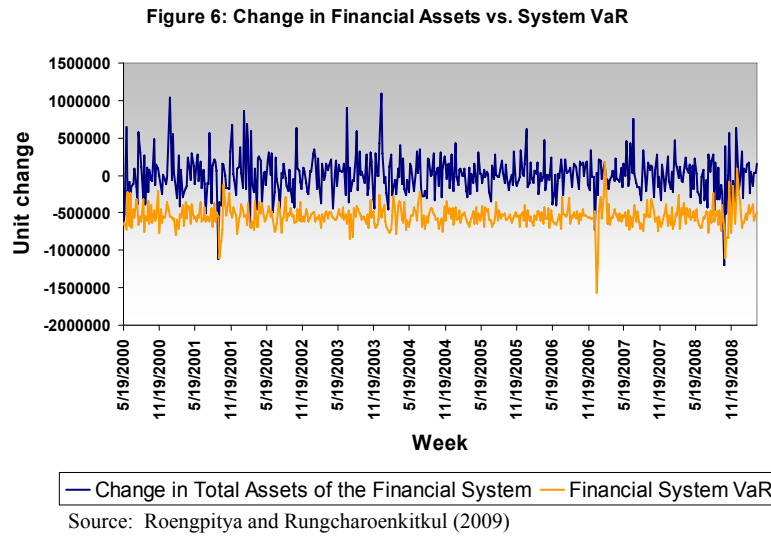
Next, to estimate the institution's ΔCoVaR, the authors presented the estimation from two aspects. First, they considered estimating ΔCoVaR for all financial institutions as a whole. Basically, they treated the universe of the financial system as being consisted of the six commercial banks, six finance and securities companies and seven insurance companies. So, the system VaR was estimated using the data from all of these institutions. However, since different types of institutions might have been collectively risky at different time periods, displaying the results as a snapshot in time might not capture the characteristics of institutions. The authors thus reported the effects of stand-alone institution VaR and ΔCoVaR as an average over all the weeks used in the estimation. The estimations are presented in Figure 7.

Figure 7: Institution's VaR vs. ΔCoVaR (Average 2000Q2-2009Q1)

Source: Roengpitya and Rungcharoenkitkul (2009)
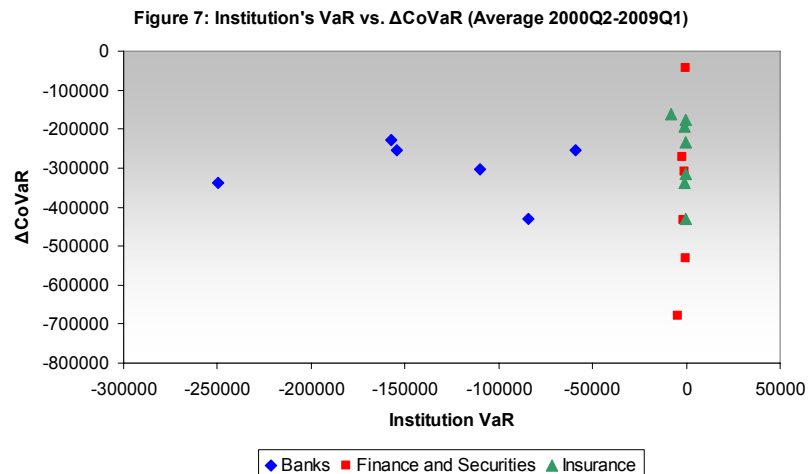
By looking at Figure 7, the sizes of ΔCoVaR imposed onto the system by banks and insurance companies were not obscenely different, with the group average of about -300,000 units of ΔCoVaR for the banking group and -263,000 units for insurance companies. The contribution to the system VaR from finance and securities companies was larger on average, with -380,000 units of ΔCoVaR, and this group also possessed an institution producing the highest level of ΔCoVaR, which was equivalent to -680,000 units, average across time.

In addition, to get a clearer picture of how the institutions of the same type contribute to the by-type system VaR, the authors re-estimated the ΔCoVaR by types of institutions separately using the same time period. Basically, they treated the universe of the financial system separately by types of financial institutions—all commercial banks, all finance and securities companies and all insurance companies. Then, within each group, the author estimated ΔCoVaR for each institution to minimize the effect of differences in shares of market cap and average ΔCoVaR and VaR over time for each institution. Then, the ratios of ΔCoVaR to stand-alone institution VaR were calculated, called "X-Times Contribution to System VaR."[18] This ratio, again, informs us the proportion of ΔCoVaR generated by an institution with respect to its own VaR.

Figure 8: X-Times Contribution to System VaR (Average 2000Q2-2009Q3)

Source: Roengpitya and Rungcharoenkitkul (2009)
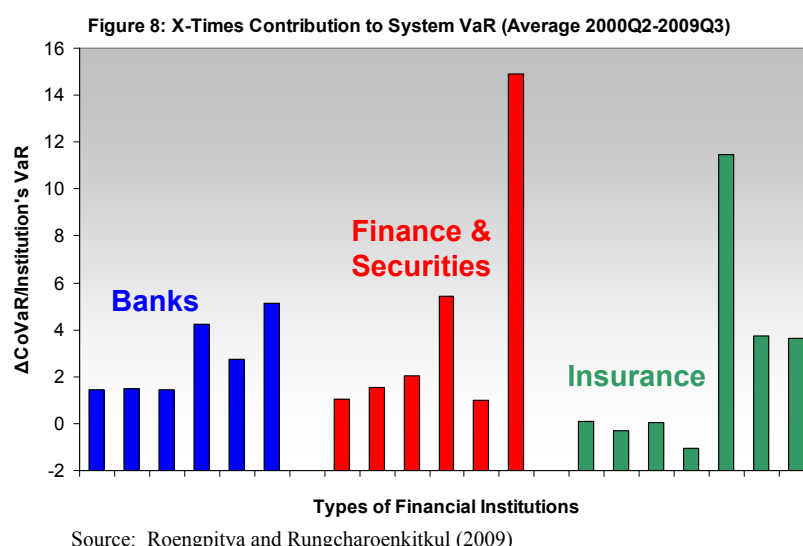
Figure 8 exhibits the ratio of ΔCoVaR to the stand-alone institution VaR in groups of types of financial institutions. For the commercial bank group, these average ratios range between 1.44-5.14.

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[18] When the ratio dips below zero, it means that when that institution is at a certain level of VaR, it created the value at risk for the system which is smaller than the system VaR at that date. It by no means should imply that that institution does not affect system VaR.

For finance and securities companies, the ratio can be up to 15 times and for insurance companies, the maximum ratio stands at 11.5 times. Therefore, the implication drawn from considering these ratios is that the negative externalities do exist in other types of institutions as well, namely finance and insurance companies and the maximum relative effect on the system, measured in proportion of the institution's own VaR, can be very large for some finance and securities as well as insurance companies.

Even though estimating the ΔCoVaR separately by groups of financial institutions may have made the direct comparison between types of institutions more challenging, what is important here is that the ratios of the ΔCoVaR to institution VaR are different between groups of financial institutions, as the non-banks possessed more volatility and extreme values. The main message is also clear about how misleading it can be if we will only consider an institution's stand-alone VaR, as there are negative externalities the stand-alone institution VaR concept fails to capture.

3.4 THE QUANTIFICATION OF FINANCIAL LINKAGES BETWEEN BANKS

This section presents the quantification of financial linkages between six Thai commercial banks, using the same data presented in Section 3.2. The details regarding the methodology used in estimating the financial linkages in this section can be found in the appendix.

Following Adrian and Brunnermeier (2008), Roengpitya and Rungcharoenkitkul (2009) measured financial linkages between banks using the concept of estimating the additional VaR of an institution, on top of its current VaR, generated by another institution when it is in distress. If Bank A is more financially linked to Bank B than Bank C, we should expect to see more additional Bank A's VaR produced by Bank B than Bank C when they are in trouble. Table 1 presents such financial linkage estimates. The number represented in each cell is the additional VaR of institutions located in the rows carried when institutions resided in the columns were at their 99-percent distress levels.

For example, from the table, if Bank B was in distress, then it created -140,853 additional units of Bank A's VaR on top of Bank A's stand-alone VaR. The bottom part of the table presents the percentage increase in the affected institution's VaR. For instance, the distressed Bank B increased

Bank A's VaR by 28 percent of Bank A's stand-alone VaR.[19] The highest inter-institution negative

externalities came from Bank C impacting Bank E, creating an additional 122 percent of Bank E's

VaR.

Table 1: Financial Linkages of 6 Thai Commercial Banks at 99% Distress Level

Actual ΔCoVaR	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
Bank A		-140853	-170703	-197513	-272262	-293998
Bank B	-128444		-119852	-26673	-193907	-130409
Bank C	-343914	-192857		-62124	-87721	-343179
Bank D	-16439	-10768	-27978		-54106	-36690
Bank E	1811	-74764	-261645	-33778		89103
Bank F	-106138	-6417	-77721	-3815	-109595	

Percent Change	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
Bank A		28	25	65	42	39
Bank B	29		35	10	59	30
Bank C	62	71		21	31	62
Bank D	17	12	24		119	39
Bank E	0	25	122	22		-17
Bank F	47	3	38	3	77	

Source: Roengpitya and Rungcharoenkitkul (2009)

It is worth noting that the numbers reported in Table 1 do not come from the same time

period. The numbers in each column will have the same date—the date when the bank in that column

had a 99-percent VaR level. For example, Bank A's distress date was on November 27th, 1998 while

Bank E's distress date was on November 7th, 2008.

The implication of such financial linkage assessment is for banks to realize what kind of

impact other banks could have had on them should the fellow banks be in distress. These financial

linkage estimations should help banks understand first how much they will be affected and,

consequently, from the degree of linkages, what can potentially be the sources (for example size, lines

of business, business strategies, etc.) of such inter-institution connections.

4. FORWARD-LOOKING POLICY OPTIONS AND REMAINING CHALLENGES

The results presented in Section 3 represent just how much more bank supervisors will have

to deal with in mitigating systemic risk in the future. In this respect, the ΔCoVaR results provide an

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[19] The negative number on this bottom part of Table 1 does not at all mean that, for example, if Bank F is in distress, then it will decrease Bank E's VaR. From the definition of ΔCoVaR, it just means that the VaR of Bank E coming from Bank F being in trouble is equal to 100-17 or 83 percent of the stand-alone VaR of Bank E.

additional tool for policy makers to assess the degree of negative externalities and financial linkages but it may be insufficient to employ only this tool to identify the systemic risk potential. Therefore, to discuss in greater details on what is left to be done, this section is divided into two parts. The first section attends to the forward-looking policy options currently being considered by central bankers. Then the second part puts forward remaining challenges facing supervisors and policy makers with regards to the systemic risk issue.

4.1 FORWARD-LOOKING POLICY OPTIONS

Since the issue of systemic risk has become a topic which receives much attention, especially during the aftermath of this recent crisis, there are many policy options being discussed. This section provides analyses on four main categories of policy tools which are being reflected on at the forefront of systemic risk policy discussion.

First, there are discussions regarding how to craft supervisory policies so that they match the specific characteristics of the regulated entities that can potentially create systemic risk. This characteristic determination is still far from being definitive—from its asset size to leverage ratio to the degree of complexity and potentially to its contribution to systemic risk. On top of identifying these institution factors, there is also an issue of what should be the appropriate implementation tools—from charging more regulatory capital to taxation to possibly purchasing insurance. In their paper, Adrian and Brunnermeier (2008) proposed that institutions should be required to hold capital not only to cover their VaR but also their ΔCoVaR, while central bankers should be aware of bank characteristics that could potentially produce a large ΔCoVaR in the future. While Brunnermeier, et al. (2009) proposed the ceiling of loan-to-value ratios for mortgage exposures (which was actually implemented by the Bank of Thailand on high-value real estate loans back in 2003), Kashyap, et al. (2008) suggested the idea of an institution having a 'capital insurance,' meaning that banks should buy capital insurance policies that would pay in case the whole financial system was to be under distress. On the level of complexity and size of financial institutions, Chairman Bernanke, on his speech at the Council for Foreign Relations on March 10th, 2009, emphasized the importance of large banks being "capable of monitoring and managing their risk in a timely manner" and thus any entity

whose failure would most lead to system distress should be monitored more closely on their risk taking strategies as well as be subjected to higher capital and liquidity standards.

Second is the topic involved the possibility of an institution failure due to heightened counterparty risk. Since the failure of one or more entities can possibly lead to the system meltdown if the default exposures and institutions are large enough, there has been a proposal to impose limits on inter-institution financial exposures (Schwarcz (2008)). The idea behind it is that putting a ceiling on such exposures can promote risk diversification, thereby limiting the loss of a contractual counterparty and also the likelihood of counterparty default. This idea, however, is not the favorite of Chairman Bernanke, as he believed that large financial institutions will seek to protect themselves from such risk, especially when lending to hedge funds, and regulators should therefore concentrate on the institution's stress testing methodology.[20] Also, since the failure of a major bank to meet its payment obligations can possibly spread fear of sequential defaults, there is a proposal for central banks to guarantee payment of transfers made by banks in order to minimize the possible payment and trade failures associated with counterparty contracts. However, this comes at a cost in a sense that banks can therefore lose an incentive to monitor their counterparties (Kaufman and Scott (2003)). This is another issue central bankers will need to think about when it comes to drafting payment-related policies.

Third, much talk has been about the disclosure of information and transparency. This is because the lack of information on the true nature and risk of complex derivatives is one of the leading causes of this recent financial crisis. A market for derivatives can wipe out the information associated with bank debt and consequently reduce welfare (Morrison (2005)). In addition, derivatives traded over-the-counter should be encouraged to trade in an organized exchange market to promote the standardization of future contracts so that the relevant economic parties will have much clearer information (Eichengreen (2008), Kregel (2008)). Also, during the distress time, if depositors and other peer banks can still differentiate the economically solvent from insolvent banks in a timely manner, the possibility of solvent independent banks being driven into insolvency rarely happens, as

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[20] Remarks by Chairman Ben Bernanke at the New York University Law School on April 11, 2007.
http://www.federalreserve.gov/boardDocs/speeches/2007/20070411/default.htm.

evident from the fact that almost all failed banks during the Great Depression were small unit banks (Kaufman and Scott (2003)). Kupiec and Nickerson (2001) suggested that transparency should help enhance the efficiency of implementing the capital adequacy ratio requirement. In fact, the disclosure of information is addressed in Pillar III of the current Basel II Framework, which is already in effect since June 2009 for banks using the standardized approach (SA) for their regulatory capital calculation and will be in effect in June 2010 for the banks employing the internal rating-based methodology.

Finally, there is an issue about panic prevention. There are two folds to this story. First, to prevent the panic of depositors that can lead to bank run, one of the policy tools used widely is to establish the deposit insurance institution (Schwarcz (2008)). The current debate regarding this policy option is about how banks should pay the premium to this institution—based on size, the level of risk, etc. Also, there is a discussion regarding the trade-off between the blanket guarantee and the moral hazard. The blanket guarantee will give depositors the comfort but may lead to excessive risk taking by bank management because they do not have to be responsible for paying back depositors at any time and consequently imposing a large social cost. Because of this same analysis, Kaufman and Scott (2000) suggested that there should be no deposit-insurance coverage of interbank transactions, as it is crucial for banks to have incentives to protect themselves from the risk associated with such transactions. Second, to prevent liquidity shortage that can potentially trigger liquidity crisis among banks, the central bank also carries a role of the lender of last resort. The central bank can facilitate the liquidity in two ways—by providing liquidity to prevent financial entities from defaulting (thereby alleviating institution-based shortage) and by providing liquidity to capital markets (and lessening the system-wide shortage). However, when considering these policy options, one needs to be aware that it might potentially lead to the same moral hazard problem by banks and cost to tax payers (Macey and O'Hara (2003)). To minimize the moral hazard cost, banks can be provided with liquidity under the agreement that the central bank possesses the right to intervene while the cost to tax payers can also be taken care of by imposing risk premiums to financial market participants (Schwarcz (2008)).

4.2 REMAINING CHALLENGES TO BANK SUPERVISORS

This section discusses briefly the remaining challenges for bank supervisors in crafting related policies to cope with financial linkage and systemic risk. Insofar, there are two key policy implications we wish to elaborate here.

First, there is a debate regarding the systemic risk measurement and detection. As mentioned previously in Section 3 and also in the appendix, some econometric quantification methods have been proposed to assess the level of financial linkages and systemic risk in the financial market. While most models rely on the credit default swap (CDS) data to assess the co-movement of probability of defaults among institutions, the ΔCoVaR measures rely on the estimation of the value-at-risk (VaR) through the change in normalized total assets. However, these econometric tools will not provide policy makers with the absolutely complete picture on the issue, not to mention that the applications of these tools and the analysis should be tailor-made to match the specific characteristics and environment of each country's financial system. Therefore, bank supervisors will need to be aware of the limitations and the explanatory power of each quantification method and use these models to help identify the underlying factors that can possibly increase the level of systemic risk identified by such models. In addition, they should keep in mind that this quantification of linkages and risk must be used in combination of other policies, such as monitoring the risk level of banks along with bank management as a stand-alone entity. They also must make certain that these institutions are aware of not only their risk but also how they are related to other institutions as well as how they will be affected if the system is to be under distress. This forward-looking view therefore should be employed by both the supervisors and bank management alike.

Finally, there still is a complication when it comes to considering the trade-off between systemic risk prevention and minimizing the moral hazard.[21] This is a classic case of the mission to strike the right balance between stability and efficiency in the system facing all bank supervisors. The policy options mentioned in Section 4.1 are examples of these trade-offs—from deposit insurance coverage to payment system guarantee to alleviating liquidity shortage. In addition, since the crisis

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[21] Speech of Chairman Yutaka Yamaguchi of the Committee on the Global Financial System at the Third Conference on Risk Measurement and Systemic Risk.

this time involved major non-bank entities in the U.S., there is also another trade-off debate on whether and how non-bank institutions should be supervised, since the risk produced by these entities can potentially spread to the banking sector. After all, the main reason why banks need supervising in the first place is because, without regulation, the externalities caused by systemic risk will not be prevented or internalized, since the motivation of market participants is to protect themselves and not the system as a whole and hence no institution will have an incentive to limit risk taking in order to reduce the contagion effect for other entities (President's Working Group on Financial Markets (1999)), while this view can possibly be true for non-bank entities as well (Kupiec and Nickerson (2001)). Therefore, bank supervisors will need to carefully consider all the possible alternatives before issuing policies so that they can internalize all the negative externalities in the system and balance well between stability and efficiency and consequently minimize the social cost.

In conclusion, although systemic risk has been an issue in banking supervision throughout history, it has become even more important after the recent financial crisis because the severity and nature of it have changed course from new financial engineering innovations and the now-crucial bank and non-bank financial linkages. It may be true that systemic risk may never be completely and costlessly eliminated from the system (Kupiec and Nickerson (2001)), especially when financial intermediation constantly evolves at an unimaginable speed, as pointed out by Chairman Yutaka Yamaguchi of the Committee on the Global Financial System. Therefore, bank supervisors and policy makers will first need to be aware of the system risk present in the system, as well as the sources of such risk, and then craft the policies so as to mitigate this risk with the least social cost. Finally, supervisors must keep the guard up at all times, even during the time when there seems to be only a small chance of severe financial distress happening.

II. COPING WITH THE PROCYCLICALITY IN THE FINANCIAL SYSTEM

The present crisis has urged the public to focus the attention on the issue of procyclicality in the financial system that can potentially have excessive effects. The term **"*procyclicality*"**[22] refers to

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[22] To avoid confusion, procyclicality refers to the tendency for banks' willingness to lend to increase during periods of strong economic growth and banks' willingness to lend to decrease during periods of weak economic

positive feedback mechanisms between the financial sector (or financial cycle, especially credit cycles) and the real sector (or economic cycle) of the economy (Borio et al. (2001), BIS (2001) and (2002)). More specifically, a certain level of procyclicality reflects the extent to which the fluctuation in the real economy is influenced by the financial sector and vice versa. This issue has gained momentum as a result of this financial crisis, which are apparent from the US Federal Reserve Chairman Bernanke's remark in January 2009, "We should revisit capital regulations, accounting rules, and other aspects of the regulatory regime to ensure that they do not induce *excessive procyclicality* in the financial system and the economy."

This section on procyclicality will be presented in three parts. First, we reviewed the causes of procyclicality, including existing regulatory issues that may in part have contributed to the procyclical nature of the system. The second section presents the quantification of the level of procyclicality in the Thai financial system. Finally, the last part concludes this topic by presenting policy options and remaining challenges.

1. CAUSES OF PROCYCLICALITY

Without differentiating among types of bank specialization, procyclicality is widely accepted as inherent problems of the banking sector (Allen and Gale, 2000). For example, in Germany, such procyclical behavior resided in universal banks, up to 1914 (Fohlin, 1998 and 2000). For Italy, such macroeconomic constraints helped explain the great banks bail-outs in the early 1930s and the banking system reform culminated in the Bank Act of 1936 (Toniolo, 1978 and 1993, de Cecco, 1997).

The real threat to the financial system is nevertheless *excessive procyclicality* (Borio, Furfine, and Lowe, 2001) where the behaviors of participants in the financial sector unnecessarily amplify swings in the real economy; thus planting the seeds for instability and reducing soundness of the financial sector by means of traditional interactions between asset prices and credit, the so-called

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growth. In addition, a variable is said to be procyclical if it moves in such a way that amplifying the business cycle. In other words, the definition refers to the impact of the variable on economic activity, not to the direction of its co-movement with activity.

financial accelerator (Bernanke, Gertler and Gilchrist, 1999), which will be elaborated in greater details later.

The current crisis has highlighted the disruptive effects of excessive procyclicality, especially in the banking sector. Banks who experienced extensive losses had difficulties replenishing their capital, which consequently led them to cut credit extension and dispose assets. The ongoing de-leveraging process made the already weakening economic conditions worsen even faster and thus increased the risk of further deterioration in banks' financial strength. As Borio, Furfine and Lowe (2001) mentioned, since risk-shifting attitudes initiated by the state of the economy were inherent in the nature of the human behavior, there was a tendency for economic agents—both lenders and borrowers—to systematically *misprice risks* over the cycle. This leads to an over-optimism during cyclical upswings, which tends to be followed by an over-pessimism during cyclical downswings.

The causes of excessive procyclicality can be classified into two groups, namely misperception of risk (or the "information imperfection" problem) and an inappropriate response to risk. First, the *misperception of risk* can be a result of well-documented cognitive biases such as "disaster myopia"[23] (Guttentag and Herring, 1984), "herding behavior" (Rajan, 1994), "institutional memory hypothesis"[24] (Berger and Udell, 2003), and the well-known "information asymmetry." For example, in case of the information asymmetry between borrowers and lenders during the cyclical downswings when collateral values are low, even good borrowers with profitable projects cannot get access to funds. During the cyclical upswings, even bad borrowers can gain access to funds, which induces further the economic expansion.

More attention is paid to the second explanation, the *inappropriate responses to risk*. This mainly arises from weaknesses in bank risk management as well as the regulatory regime, which can be potentially solved. Two sources of inappropriate responses to risk are *difficulties in measuring risk* and *the incentive misalignment of market participants*. A good example of the latter will be the management's compensation, which is usually linked to the short-term (non risk-adjusted)

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[23]Disaster myopia refers to the tendency that agents underestimate the likelihood of high-loss but low-probability events.
[24] Institutional memory hypothesis refers to the case that lending institutions may tend to forget the lessons they learned from their problem loans as time passes since their last loan bust

performance and consequently explicitly encourages risk-taking behavior. This exacerbates further the cycle swings.

Accordingly, the measurement difficulties encourage mispricing of risk. During cyclical upswings, an underestimation of risk leads to excessive credit growth, inflated collateral values, low lending spreads, and relatively low capital and provisions holding. During cyclical downswings, when risk and credit default are perceived to be high, the reverse tends to occur. Consequently, the measurement weaknesses have been powerful factors contributing to the amplification of cyclical upswings and thus heighten the severity and length of cyclical downswings.

Given the reasons why excessive procyclicality exists in the first place, we next attempted to identify the key drivers that may have contributed to procyclicality in the financial system. Three key areas[25] worth considering are valuation and leverage, regulatory capital framework, and loan loss provisioning. Leverage is important because it represents the willingness of entities to take risk. The higher the leverage, the more risk an institution take. *The interplay between the financial sector leverage and the real economy leverage* creates excessive leverage in the system as a whole, leading to the system's vulnerability. In addition, *financial sector leverage* can possibly contribute to financial entities having substantial risk, unless their risk management can appropriately create buffer during good times so that it can be drawn down in bad times. Therefore, *valuation*, which acts as risk pricing tools, plays a crucial role in assessing such buffer. Mispricing of risk through valuation techniques will affect the level of buffer over the cycle and, consequently, *loan loss provision* and *bank capital* since, in principle, this primary cushion takes the form of provision and capital.

1.1 VALUATION AND LEVERAGE

First, *leverage*[26] is a position where an entity is exposed to more risk than its equity capital. Therefore, it can potentially magnify the level of risk in the system. Leverage can be defined for three

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[25] According to Financial Stability Forum (2007), "Report of the Financial Stability Forum on enhancing market and institutional resilience"

[26] Leverage has particular definition to each sector. For example, bank leverage (or traditional balance sheet leverage) is defined as assets-to-total equity. Non-banking sector leverage consists of household sector leverage, defined as debt-to-assets, and corporate sector leverage, defined as debt-to-equity.

different cases—financial sector leverage,[27] real economy leverage, and embedded leverage.[28] It is important to understand the mechanisms and interplay between these leverages in order to understand a clear-cut picture of regarding the causes of the current crisis.

The dynamic of this leveraging process that contributes to procyclicality will be explained as follows. First, the global imbalance and excess liquidity leads to yield-seeking activities in the market, as mentioned earlier. As a result, the *financial sector leverage* starts to increase rapidly with the support from the introduction of embedded leverage in structured products, such as collateralized debt obligation (CDOs), off-balance sheet vehicles, as well as changes in business models from originate-and-hold to originate-and-distribute.[29] Next, growing financial sector leverage implies the relaxation of funding constraints that encourage the household and corporate sectors to take more risk. Thus, the *real economy leverage* begins to augment, which could be seen in the case of the U.S. prior to the crisis (Figure 9). This interaction between the financial sector and the real economy finally results in *higher asset prices*, which are normally property prices, as it is the principal form of collateral required for obtaining credit issuance. The adverse effect of excessive leverage is disclosed during the stress condition as leveraged entities are forced to unwind assets in order to reduce their exposures—the so-called "deleveraging process"—thus exacerbating the financial instability.

One popular theoretical perspective, *"the leverage cycle,"* was proposed by Geanakoplos (2009). He mentioned that the market equilibrium determined not only interest rates, but also the leverage level. In his paper, he showed that the more the optimists, or natural buyers, could borrow, the fewer of them would be needed to buy all the assets, but the higher would the price be. The excessive leverage in the cycle is mainly driven by competition, while the de-leveraging process can begin with scary bad news, followed by uncertainty and price swings. In summary, this enhances the importance of macro-prudential approaches implemented to curb excessive leverage in the cycle, in addition to the traditional monetary policy tool like interest rates. However, there are also main arguments against such idea which will be discussed later in section 3.4.

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[27] Throughout this paper, we refer financial sector leverage as banking sector leverage.
[28] A position with embedded leverage is a position with an exposure larger than the underlying market factor such as CDOs position.
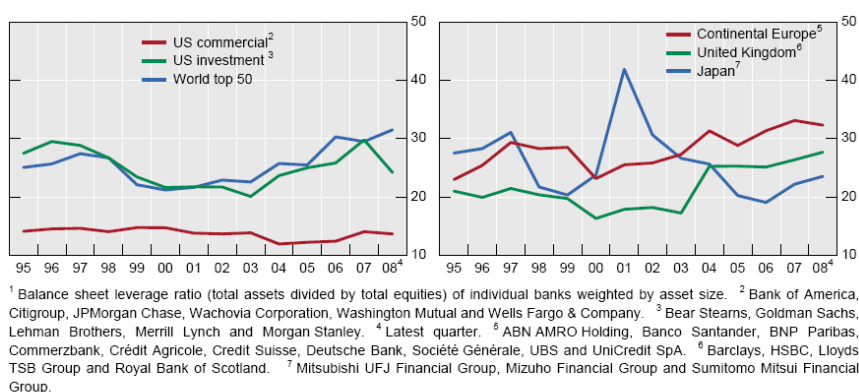[29] An originate-to-distribute (OTD) refers to the model of lending, where the originator of a loan sells it to various third parties.

Figure 9: Household sector leverage, Debt / total financial and non-financial assets (%)
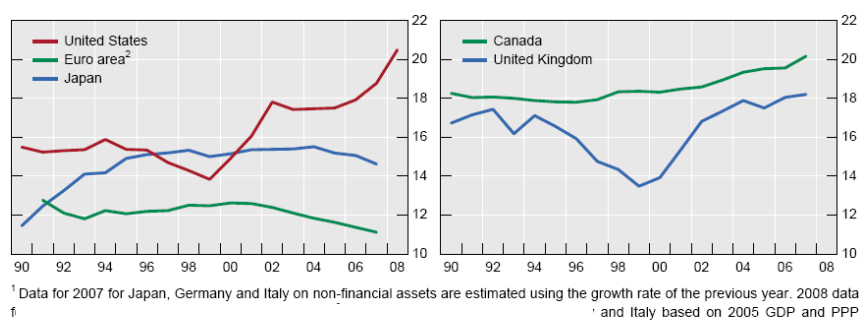
However, the current crisis has drawn much attention to *embedded leverage*, as *traditional financial sector leverage* (Figure 10) failed to signal the build-up of risk prior to the crisis because it was developed in less visible ways. Embedded leverage gained popularity from structured credit products, such as CDOs, whose nature made investors blind to the level of leverage they were exposed to. Another important source of the less visible leverage in this recent crisis was the *leverage of the off-balance sheet vehicles*. Off-balance sheet leverage also played a crucial role as, prior to crisis, assets under off-balance sheet vehicles such as bank's SIVs[30] accumulated dramatically. This provided clear evidence regarding the regulatory arbitrage in the U.S. case. Substantial impact emerged when market liquidity deteriorated and the vehicles suffered huge losses, thus posing risk to the sponsored banks.

Figure 10: Bank balance sheet leverage ratio, total assets / total equities

[1] Balance sheet leverage ratio (total assets divided by total equities) of individual banks weighted by asset size. [2] Bank of America, Citigroup, JPMorgan Chase, Wachovia Corporation, Washington Mutual and Wells Fargo & Company. [3] Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch and Morgan Stanley. [4] Latest quarter. [5] ABN AMRO Holding, Banco Santander, BNP Paribas, Commerzbank, Crédit Agricole, Credit Suisse, Deutsche Bank, Société Générale, UBS and UniCredit SpA. [6] Barclays, HSBC, Lloyds TSB Group and Royal Bank of Scotland. [7] Mitsubishi UFJ Financial Group, Mizuho Financial Group and Sumitomo Mitsui Financial Group.

Source: Joint FSF-CGFS Working Group

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[30] From Wikipedia, a structured investment vehicle (SIV) was a type of fund in the shadow banking system. Invented by Citigroup in 1988, SIV's were popular up until the market crash of 2008. The strategy of these funds was to borrow money by issuing short-term securities at low interest and then lend that money by buying long-term securities at higher interest, making a profit for investors from the difference.

With this understanding of the leverage dynamics between the financial sector and the real economy, we now proceed to investigate the original source of procyclicality within the financial system. This main source is the misalignment between *buffers* and *financial sector leverage* through *valuation*. While the amplifying process between financial sector leverage and real economy leverage is mainly driven through a credit channel, mispricing within the financial sector, particularly banks, can have an impact on almost all balance sheet items via their valuation. As a result, valuations can affect reported profit, provision, capital, and risk management measures and, consequently, can influence investment decisions. One might think of valuation as a risk-pricing tool where it works as follows. Underestimating risk during cyclical upswings means inducing a risk appetite and excessive leverage. On the other hand, overestimating risk during cyclical downswings encourages risk aversion and thereby accelerates the deleveraging process. In other words, financial sector leverage is the mechanism that helps amplify the outcome of risk mispricing. Therefore, the interplay between financial sector leverage and buffers leads to procyclicality, which is the reasoning behind the term "*procyclical leverage.*" In summary, mitigating the procyclical relationship between valuation and financial sector leverage seems desirable if one wants to enhance the stability of the financial system.

Regarding the regulatory-related issues with regard to leverage and valuation, it is worth mentioning first the use of the *fair value principle*. Although this principle adheres to the need to reflect the current market expectation, it also leads to a more volatile balance sheet. In addition, during the adverse market condition, banks face difficulties from the collapse of some certain markets, causing the fair value technique to be less reliable. One solution proposed by IASB[31] is the *reclassification of financial assets*; for instance, reclassifying from trading to non-trading categories. This means these assets will not need to be marked to market during the adverse market condition. According to the Thai accounting standard, such practice will be allowed in the year 2011, when SET 50 companies will have to comply with IFRS.[32] However, to employ such solution permanently will lead to a concern about how to define the adverse market condition. Moreover, IASB proposed that the bank would need to *disclose three levels of fair value*, notably (mark-to-market) quoted market

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[31] Refers to International Accounting Standards Board.
[32] Refers to International Financial Reporting Standards

price in exchange, price based on market observable data such as implied volatility, and (mark-to-model) model price based on assumptions which would also be required to disclose. Currently, this disclosure requirement is already incorporated into the BOT's accounting regulations.

1.2 CURRENT CONTRIBUTION OF REGULATORY FRAMEWORK

Another potential source of the misalignment between financial sector leverage and buffers is the capital of a bank, as it appears to be a key driver of a bank's risk-taking behavior and a key indicator of the mispricing of risk. The introduction of a new risk-based capital standard, Basel II, was claimed, by nature, to be a potential source of procyclicality.[33] On one hand, Basel II is intended to implement *risk sensitive measures* used to estimate the necessary capital cushion so that it better reflects the underlying risk and limits the scope of regulatory arbitrage. On the other hand, even with the forward-looking and downturn-accountability in the risk parameter estimation principle used in the regulatory capital calculation (especially the credit risk for IRB banks), higher risk-sensitive capital may still lead to procyclicality, as the level of capital tends to fall during cyclical upswings when measured risk is low and to rise during cyclical downswings when measured risk is high.

The current worldwide discussions point out some weaknesses in the regulatory capital principle, specifically the Basel II framework. First, the risk-based capital requirement in Basel II alone is not enough to protect the financial stability in a sense that it cannot detect excessive leverage that induces the system's vulnerability because leverage can appear in less visible ways. Other non-risk based measures may need to be considered in addition to the current framework. This issue will be further discussed in section 3.1.

Second, Basel II itself is a potential source of procyclicality, especially under the current *market risk framework*. Since the onset of the crisis in 2007, losses in many banks' trading books have been significantly higher than the minimum capital requirement under Pillar I. *Value-at-risk (VaR)* has been proved to be procyclical because the estimated inputs, such as volatility and correlations of future price changes, mostly rely on the short-term historical data rather than through-

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[33] For instance, *"Report of the Financial Stability Forum on Addressing Procyclicality in the Financial System"* states that *"…given the way measures of risk behave, higher risk sensitivity implies that minimum capital requirements on a given portfolio tend to move procyclicality…"*

the-cycle and forward-looking data, not to mention that more weights are usually given to the recent observations. Although most Thai banks have not yet applied for the Internal Model Approach, we believe it is imperative to understand and learn the lesson. Recently, the Basel Committee on Banking Supervision (BCBS) released the final package of measures aimed at enhancing the three pillars of the Basel II framework, also mentioned earlier in the topic regarding systemic risk, along with the 1996 Market Risk Amendment. In this section, we will discuss the enhancement on Pillar I and only the liquidity-related issues on Pillar II.

Key enhancements under market risk framework[34] in the Internal Models Approach are the introduction of a stressed value-at-risk (VaR) and additional capital requirement for defaults and rating migrations. *A stressed value-at-risk (VaR)* capital requirement is intended to replicate a VaR calculation that will be generated during periods of stress and is expected to help reduce the procyclicality of the minimum requirements for market risk. Stressed VaR is based on a continuous 12-months period of significant losses with respect to the bank's portfolio. This stressed VaR should be implemented in addition to the existing VaR requirement. For an additional capital requirement for defaults and rating migrations, changes are intended to address the shortcomings of the current VaR framework that fails to capture some key risk, such as credit migration, widening of credit spreads, and loss of liquidity. Therefore, the value-at-risk (VaR) based capital requirement will be supplementing an *incremental risk capital (IRC)* that captures such risk.

Another key enhancement of the Basel II framework is *a higher capital requirement for resecuritization and exposures to off-balance sheet vehicles.*[35] These are the areas that require further regulatory scrutiny after the recent financial crisis. Resecuritization exposures,[36] such as CDOs of ABS, will now be differentiated from the securitization exposures and will be applied higher risk weights to better reflect the risk inherent in these products. Moreover, credit conversion factors (CCFs) for liquidity facilities to off-balance sheet vehicles have been raised as well, as mentioned

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[34] *Revisions to the Basel II market risk framework* (BCBS, July 2009) and Guidelines for Computing Capital for Incremental Risk in the Trading Book (BCBS, July 2009)
[35] *Enhancements to the Basel II Framework* (BCBS, July 2009)
[36] Resecuritization exposure is defined as a securitization exposure that the risk associated with an underlying pool of exposure is tranched and at least one of the underlying exposures is a securitization exposure. Furthermore, an exposure to one or more resecuritization exposure is considered a resecuritization exposure.

previously in the systemic risk section. Finally, banks are expected to have more rigorous credit analyses regarding the externally-rated securitization exposures.

Another principle needed improving is the *fair value option*. During the adverse market condition, some markets freeze. Therefore, the rationale of fair value option that should reflect the current market expectation becomes obscure and unreliable. Proposals for this issue are the use of supervisory judgment if a fair valuation is not adequately prudent and the introduction of a reserve charge for illiquid positions. *Supervisory judgment* always leads to various standards of estimations, even on the same instrument. Therefore, further details and standardization are needed in order to implement this proposal. Also, a *reserve charge* should be established to adjust the current valuation of less-liquid positions for the regulatory capital purpose. Although this measure can be used to capture residual risk (or liquidity risk) of a market position, there still is a single guideline and banks may have different methods for applying the adjustments and the reserve setting.

Third, another important source might be *funding liquidity risk*. It behaves procyclically due to the relationship with market and credit risk. Every crisis has the same risk evolution. It always starts form the breakdown of market and credit risk, which leads to liquidity crunch, and then ends with systemic risk. The apparent linkage between credit, liquidity, and systemic risk is the mechanism of rating-based triggers, where credit rating downgrades can trigger collateral calls and forced sales of asset, potentially adding to funding pressures. This was the problem with the international insurance company AIG. The stage of liquidity crunch is always subsequently followed by the systemic impact because of the failure to take care of good borrowers in bad times.

The root causes of liquidity problems in the recent crisis might be mainly attributed to the reliance on *short-term wholesale funding*, on *securitization*, and on *collateral arrangements*. However, upon a closer look, those fundamental causes do not appear to be the main issues for Thailand, as Thai banks mostly rely on domestic deposits. In addition, the securitization market is not widespread yet.[37] For collateral arrangements, the Asian crisis provided useful experience to the banks. Now, most Thai banks depend more on the ability to repay of obligors, rather than the

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[37] BOT plans to issue new regulation for the treatment of securitization transaction in accordance with Basel II framework by the first quarter of 2010

collateral values, for loan issuance. But as Berger and Udell (2003) mentioned, as time passed, lending institutions might tend to forget the lessons they learned from their problematic loans since the last bust and hence we cannot be complacent. Currently, the Basel Committee on Banking Supervision (BCBS) is working on proposals to strengthen the quality, consistency, and transparency of banks' capital base.

Last but not least, there is also procyclicality arisen from provisioning. It plays a role in exacerbating the cyclical downswings because banks are typically required to have more provision, thus reducing earnings and the ability to bolster their capital. Earlier recognition by incorporating available credit information (through-the-cycle and forward-looking concepts) of loan losses can alleviated the problem. However, it is currently not permitted under the current accounting requirement, IAS39.[38] The IAS39 principle is based on the concept of incurred losses. Therefore, the provision for loan will be realized only when events which are likely to result in a non-payment of a loan in the future occur. In addition, the loss event identification is a difficult and subjective process, leading to a variety of practice and possibly a failure to fully recognize credit losses early in the credit cycle. Consequently, supervisors tend to favor the expected loss model. Meanwhile, accountants and auditors contend that this concept hinders transparency and fair value, thus potentially leading to the financial statement manipulation. Therefore, the problem is how to wisely balance between the transparency of financial statements and the prudential aspects of regulatory expectations. The policy responses will be discussed in section 3.2

After examining the possible causes and related supervisory issues, we next attempted to quantify the level of procyclicality in the Thai financial system as well as investigate its nature and variations by asset class.

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[38] According to International Accounting Standards Board (IASB), *"IAS39 Financial Instruments: Recognition and Measurement"* refers to international accounting standards. The objective of this standard is to establish principles for recognizing and measuring financial assets, financial liabilities and some contracts to buy or sell non-financial items. In 2006, BOT has partial adopted IAS39, before the Thai Accounting Standards, on impairment of financial assets to provisioning rule for NPL. As a result, banks set aside extra provisions for potential losses (total increased provision for 2006-2007 amounted to 149 billion baht).

2. ASSESSING LEVEL AND NATURE OF PROCYCLICALITY IN THE THAI FINANCIAL SYSTEM

In this section, we endeavored to quantify the extent of procyclicality of the banking sector in Thailand. Although the Thai banking sector was spared from the direct impact of this financial crisis, it is desirable for us to examine the procyclicality issues to better understand the accumulation of risk over time. First, we observed the extent of procyclicality at first glance by investigating the cyclical behavior of real GDP, real bank credit,[39] and real property prices. Real GDP is the standard variable used to measure business cycle, while real credit growth reflects the role of the financial sector in the cycle. Property prices are the most relevant asset price because it is the principal form of collateral required to obtain credit. Strong correlations indicate the co-cyclical movements, while weak correlations mean that there is no relationship between economic and credit cycle.

Second, panel data regressions of bank specific data were used to determine the types of co-movements, giving more information relative to the first investigation. Economic models and data will be discussed in the appendix 3A. Using the real credit growth as our dependent variable, we then defined the coefficient of real GDP growth rate from the regression as follows. If it is below zero, it exhibits "*anti cyclicality*," and if it is higher than zero but below one, it becomes "*mild procyclicality*." If it is higher than one, we classified it as having "*excessive procyclicality*." To avoid the confusion, we try to organize the term "*procyclicality*" clearly and systematically, as shown in Figure 11.[40] Additionally, we attempted to identify the banking sector variables contributing to procyclicality in the financial system so that policies can be developed to limit risk to macroeconomic and financial stability.

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[39] In the entire study, bank credit refers to credit to private domestic sector, used in real terms adjusted by CPI.

[40] This determination process is designed by the authors and might be different to the others. According to Borio, Furfine and Lowe (2001), The term "procyclicality " refers to positive feedback mechanisms between financial sector and real sector, while "excessive procyclicality" refers to the financial sector that unnecessarily amplifies swings in the real economy

Figure 11: Definitions of the Financial System's Procyclicality
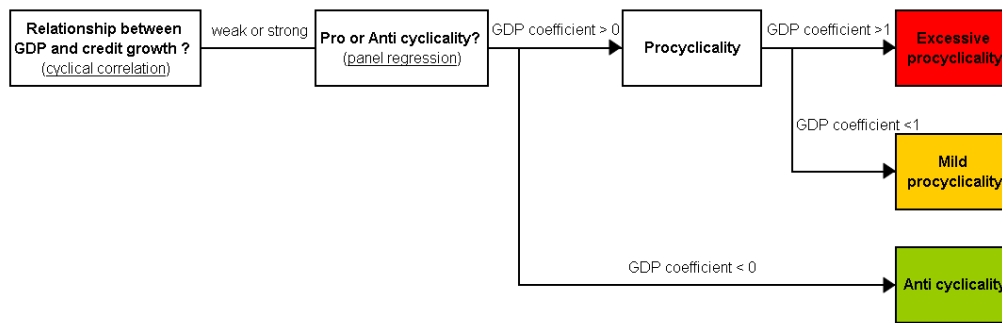
2.1 LEVEL OF PROCYCLICALITY: AT FIRST GLANCE

Upon the first glance, *over the whole period,* the average growth rate of bank credit against different ranges of economic growth is plotted in Figure 12. The panel broadly exhibits a positive relationship. From the figure, the higher the economic growth rates were, the higher was the average growth rate of bank credit. Moreover, credit seemed to grow faster than GDP during cyclical upswings and relatively slower when the cycle entered the cyclical downswings. For example, during cyclical upswings, GDP expanded 7-10% on average, while credit grew at 10.25%. During cyclical downswings when GDP expanded 3-5% on average, credit grew at least 1.87%.

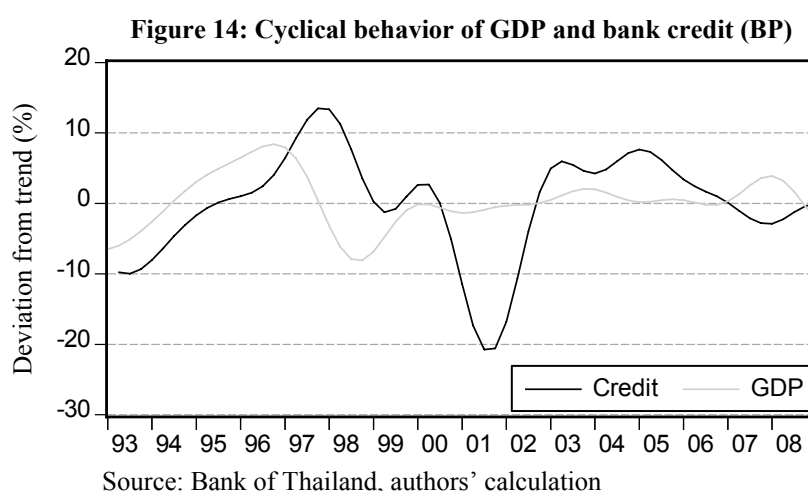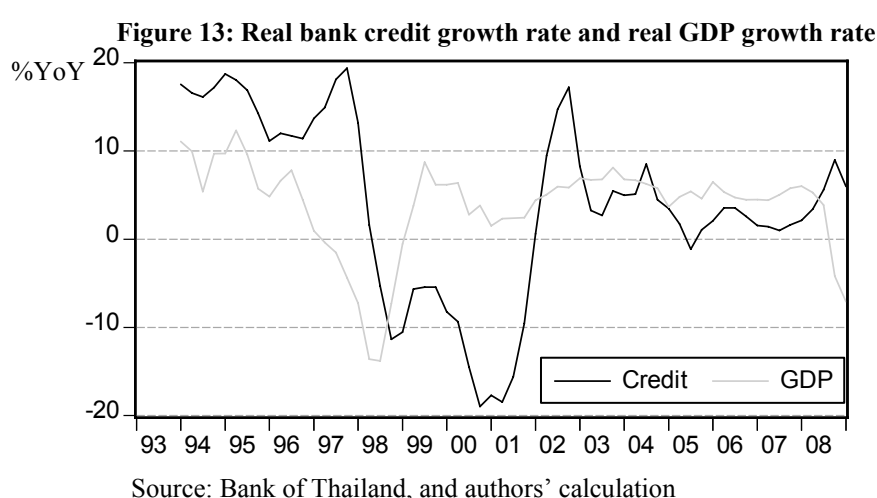**Figure 12: Growth of bank credit and GDP (range, 1993Q1 – 2009Q1)**
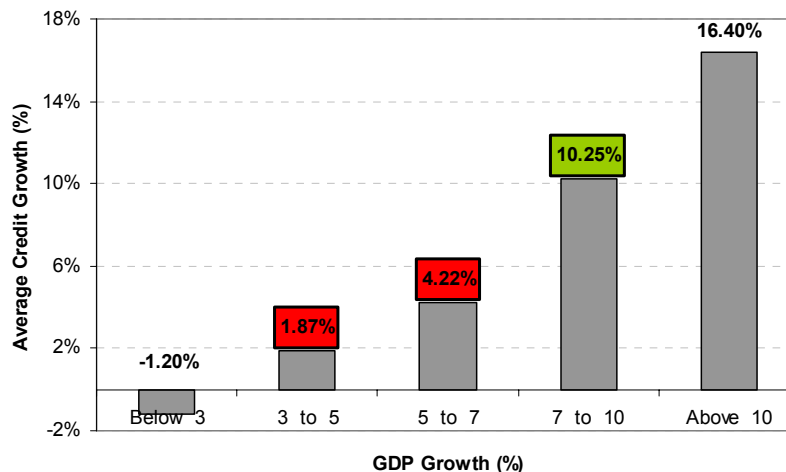
Source: Bank of Thailand, and authors' calculation

We moved further to examine both credit and GDP growth over time. Figure 13 shows the strong relationship between credit cycle of the Thai banking system and the economic cycle with a certain lag *up until the Asian crisis (1998).* However, the pattern seemed to be unclear thereafter.

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This strong relationship is confirmed by calculating the correlation between their cyclical patterns that will be discussed next.

Subsequently, we apply Band-Pass (BP) filter[41] to GDP and bank credit, as demonstrated in Figure 14.[42] Up until the crisis, the credit cycle prominently followed the economic cycle with a certain time lag.[43] To calculate the cyclical correlation, we then divided the whole sample into two sub periods, up until the Asian crisis (1993Q1 – 1998Q4) and after the crisis (2003Q1 – 2009Q1).[44] The correlation up until the crisis was 0.62[45] and decreased substantially to 0.27 after the crisis as shown in Table 3.

Figure 13: Real bank credit growth rate and real GDP growth rate

Source: Bank of Thailand, and authors' calculation

Figure 14: Cyclical behavior of GDP and bank credit (BP)

Source: Bank of Thailand, authors' calculation

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[41] Christiano-Fitzgerald full length asymmetric band-pass filter
[42] There are regulatory changes during the period; write-off (2001) and write-back (2002)
[43] However, we do realize that our finding is based on only one economic cycle due to data limitation.
[44] The period between 1999Q1 – 2002Q4 is removed because there are breaks due to regulatory change; loan loss provision's write-off (2001) and loan loss provision's write-back (2002)
[45] Cross-correlation with fourth lag

Table 3: Correlation of real GDP, real bank credit, and the housing prices

(Cyclical) Correlation between		1993 - 1998	2003 - 2009
GDP[*] and	Total credit	0.62	0.27
	Corporate	0.59	0.28
	Consumer	0.60	-0.26
House price index[**] and	Consumer	0.87	0.39

[*] GDP leads credit by approximately four quarters except consumer credit lead by 1 quarter. Number of periods are determined by cross-correlation technique.

[**] House price index lags credit by approximately four quarters.

Next, we examined the cyclical behavior by asset classes, corporate and consumer, as shown in the first three figures in the appendix. The results showed similar patterns as the result of total credit, while the relationship between both types of assets and real GDP was weakened after the Asian crisis. As shown in Table 3, the correlations between corporate credit and real GDP, and between consumer credit and real GDP, dropped from 0.59 and 0.60 during the period up until the crisis to 0.28 and -0.26 after the crisis respectively. In addition, since half of the consumer loan in Thailand is mortgage loan and property prices should be the most relevant asset price to this loan in its principal form, we investigated also the relationship between the housing price cycle and the consumer credit cycle. As expected, the result showed a stronger relationship than when compared to the real GDP which represented the economic cycle. This finding confirms our initial hypothesis. In summary, the *cyclical behavior between GDP and credit had a strong relationship up until the crisis, and decreased substantially after the crisis*.

Figure 15: Credit to GDP
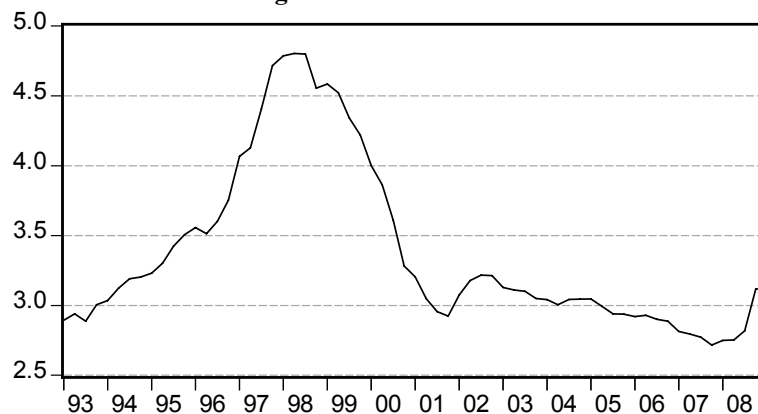
Source: Bank of Thailand, and authors' calculation

More importantly, credit did exhibit not only a strong relationship up to the crisis, but also showed some level of procyclicality. As shown in Figure 15, during that period, credit expanded faster than real GDP during cyclical upswings and relatively slower when the cycle entered the cyclical downswings.

2.2 PROCYCLICALITY OF TOTAL CREDIT GROWTH IN THAILAND

Our next objective is to assess the degree of procyclicality in Thailand. Later in this part, we would identify the bank specific variables that contributed to procyclicality in the financial system. Two variables we would like to emphasize are provision and risk pricing. We estimated the procyclicality level via unbalanced panel regressions (with bank-level fixed-effect), using bank-specific and macroeconomic data. Our method was inspired by Craig, Davis, and Pascual (2006). The detailed explanation on the methodology used to estimate the level of procyclicality in our study can be found in the appendix.

Table 4: Results for Bank Total Credit Growth in Thailand

Independent variables	Dependent variable : annual growth of real total credit		
	Key regressor : annual growth of real GDP		
	Whole period (1993 - 2009)	Until the crisis (1993 - 1998)	After the crisis (2003 - 2009)
Constant	115.77***	53.38***	124.51***
	(0.00)	(0.00)	(0.00)
Macro			
GDP growth	1.09***	0.79***	-0.41
	(0.01)	(0.00)	(0.47)
Inflation	1.28	0.68*	3.72*
	(0.11)	(0.09)	(0.08)
Real interest rate	2.77***	0.47**	5.08**
	(0.00)	(0.03)	(0.04)
Bank specific			
Loan / Asset (-4)	-1.82***	-0.48**	-1.84***
	(0.00)	(0.05)	(0.00)
Loan / Deposit (-4)	-0.05*	-0.03	-0.05*
	(0.06)	(0.64)	(0.05)
Pricing margin (-4)	-1.52**	0.36	5.08**
	(0.02)	(0.14)	(0.01)
Capital ratio (-4)	0.48*	-1.12**	0.32
	(0.08)	(0.02)	(0.53)
Bank dummy	Yes	Yes	Yes
Crisis dummy	Yes		
Obs	651	119	313
Adj R-squared	0.5150	0.7026	0.3686

Source: Bank of Thailand, and authors' calculation

We tested to see whether there was a relationship between real GDP growth and real credit growth during the time period in consideration. According to our definitions of different levels of

procyclicality in Figure 11, we were interested in the sign, size, and significance of the coefficients of the real GDP growth, using real credit growth as a dependent variable, controlling for other macroeconomic factors (namely inflation and real interest rates) and bank characteristics (as in loan-to-asset ratios, capital ratios, asset margin and loan-to-deposits ratios). The results of the estimation are summarized in Table 4 above.

From Table 4, the coefficient on real GDP growth rate (a proxy of economic cycle) was 0.79 up until the crisis and not statistically significant after the crisis. Such result confirms the initial finding that showed a weaker relationship of the cycles. Based upon the definitions shown in Figure 11, we concluded that the financial system in Thailand exhibited "*mild procyclicality*" before the crisis. This may seem to be somewhat counterintuitive, given the fact that the Asian crisis was originated from Thailand. Consequently, we explored further the level of procyclicality for each asset class because the analysis on total loan alone did not yield a definitive answer. We conjectured that different types of loans might have different relationships with the economic cycle. We believed that the estimation of consumer credit would show "*excessive procyclicality,*" though data limitation was our main constraint. The evidence of our conjecture will be shown in the next part.

2.3 ASSESSING THE LEVEL OF PROCYCLICALITY BY LOAN TYPES

Upon consulting with the data, we expected that the procyclicality nature of real loan growth may have been different depending on loan types. Therefore, we chose to examine the procyclicality relationship by asset class, notably, separating between corporate and consumer credit. The results of the panel data regression estimations for corporate credit are presented in Table 5. Due to data limitation, we could only assess such level during the post-Asian Crisis period.

For corporate credit, the coefficient on real GDP growth rate was not statistically significant, but all bank specific variables were significant, implying that credit decision relied mainly on a bank's capacity itself. On the other hand, for consumer credit, the coefficient on real GDP growth rate was significant at -2.39, in line with the negative relationship of the cycles (Table 3) and pointing to the "*anti-cyclicality*" nature, while all banking specific variables was not significant except for the BIS ratio. This result implies that consumer credit decision depended largely on economic cycle.

Table 5: Results for Bank Consumer and Corporate Credit Growth in Thailand

Period : After crisis (2003Q1 - 2009Q1)			
Dependent variable : annual growth of real corporate and consumer credits			
Key regressor : annual growth of real GDP			

| Independent variables	Corporate credit	Consumer credit	
		without housing prices	housing prices
Constant	119.00***	-54.8*	-45.04
	(0.00)	(0.09)	(0.15)
Macro			
GDP growth	1.21	-2.39***	-2.85***
	(0.15)	(0.00)	(0.00)
Inflation	2.92	1.94	3.21
	(0.41)	(0.54)	(0.30)
Real interest rate	3.75	-1.14	2.96
	(0.32)	(0.73)	(0.38)
Bank specific			
Loan / Asset (-4)	-2.13***	0.06	0.13
	(0.00)	(0.89)	(0.76)
Loan / Deposit (-4)	-0.09***	-0.11	-0.18
	(0.01)	(0.51)	(0.26)
Pricing margin (-4)	7.20**	4.09	12.37***
	(0.02)	(0.12)	(0.00)
Capital ratio (-4)	2.14***	4.97***	4.89***
	(0.02)	(0.00)	(0.00)
Additional			
Housing price growth (-4)			-1.33***
			(0.00)
Bank dummy	Yes	Yes	Yes
Obs	283	275	275
Adj R-squared	0.5810	0.6666	0.6906

Source: Bank of Thailand, Real Estate Information Center, and authors' calculation

The explanations for these results are that, for corporate lending, most banks have their own business strategies and target sectors where they possess more information than their rivals. The loan origination for corporate credit usually depends very much on the characteristics of banks, as well as their lending capacities. Moreover, due to the relatively low level of investments since the crisis, real GDP might not be a big driver for corporate loan issuance. For consumer loan, our conjecture is that during the post crisis period when GDP was relatively stable and investments remained at a low level, banks would to shift their target to consumer lending. As a result, consumer credit seemed to expand more than corporate loan (Figure 16), then acted as a stabilizer during the cyclical downswings.

More evidence to support the anti-cyclical behavior of consumer credit is illustrated in Figure 16. The picture clearly presents the opposite movements between consumer and corporate credit cycles during the post crisis period, while real GDP growth was relatively constant. This conforms to the regression results which show different signs of the coefficients on real GDP—negative for consumer and positive for corporate. While consumer credit appeared to be *anti-cyclical*, corporate

credit might be *excessive procyclical*, as the coefficient on real GDP growth rate was positive and significant at 15 percent.

Figure 16: Real bank credit growth rate and real GDP growth rate (quarterly, 2003Q1 – 2009Q1)
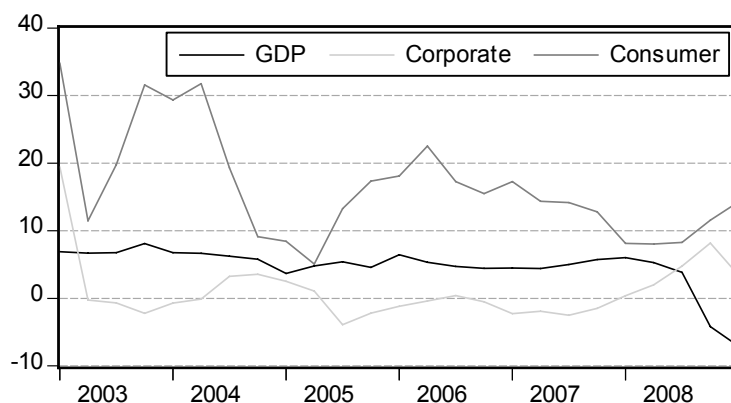
Source: Bank of Thailand, Real Estate Information Center, and authors' calculation

Figure 17: Real bank credit growth rate and real GDP growth rate (semi-annual, 1994H1 – 2008H2)
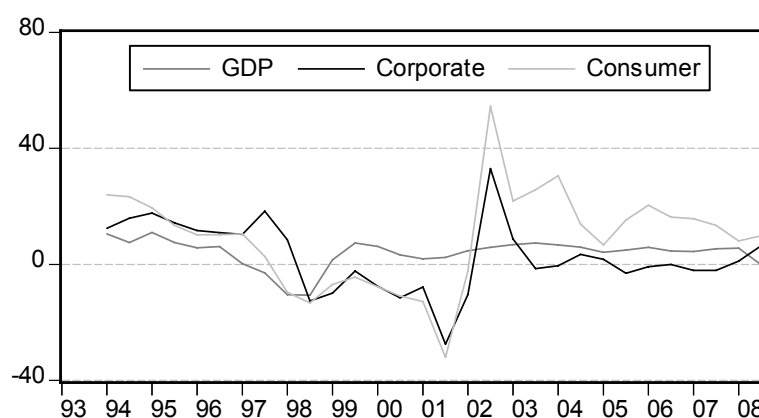
Source: Bank of Thailand, Real Estate Information Center, and authors' calculation

Moreover, Figure 17 shows that the characteristics of consumer loan have changed dramatically after the crisis.[46] Up until the crisis, consumer and corporate credits tend to move together and in the same direction as real GDP. However, after the crisis, they moved in different directions and the regressions revealed that corporate credit moved in the same direction as real GDP while consumer credit behaved differently. Possible explanations might be as follows. Profitable banks have capacity and incentives to lend. While corporate lending had not been attractive due to low level of investments and relatively constant GDP, consumer loan became a more promising area. However, we do believe that, without the better risk management after the crisis and implementations

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[46] There are regulatory changes during the period; write-off (2001) and write-back (2002)

of BOT's macro-prudential measures (such as measures on real estate loans (2003), on credit card business (2004), and on personal loan (2005)), there is a possibility of *excessive lending* on consumer credit since 2003, as depicted in the Figure 16.

Initially, it is desirable for us to have anti-cyclical consumer credit because it can help stimulate the economy while the investment and therefore corporate credit cannot function properly yet. However, to determine what level of this anti-cyclicality is most appropriate for Thailand needs to be researched further. It is also possible that the best solution for Thailand might be just having mild procyclical and mild anti-cyclical for both asset classes to enhance stability. This will be our future challenge. Furthermore, we might raise a question; "Is this symmetry between cyclical downswings and upswings?" Our answer is may be not. When the significant cyclical upswings happen and corporate lending may start to grow rapidly, we do not believe that consumer loan, as a cyclical stabilizer, will drop significantly. Therefore, we had better be prepared for that coming period.

2.4 ADDITIONAL TESTING ON CONSUMER CREDIT'S ANTI-CYCLICALITY NATURE

With interesting results that consumer credit exhibited the anti-cyclicality nature, we would like to investigate more on this issue. First, we tested to see whether the consumer credit relied excessively on collateral. The correlation between the real house price growth and real GDP growth was 0.33 and both of them were significant in explaining real credit growth. However, their coefficients appeared to be negative, demonstrating the anti-cyclical behavior. This, in turn, implies that consumer credit recently had not relied on collateral value when house price is a primary form of collateral. Although we believe that the coefficient on the real house prices growth rate should be positive and significant before the crisis, we could not proceed to test our hypothesis further due to the data limitation.

Next, we checked for the compression of lending margin during cyclical upswings. This involves testing for effects of real GDP and credit growth on interest margins. Estimation results showed that pricing margin was counter cyclical up until the crisis, as the positive coefficient on real GDP growth indicated the widening pricing margin during cyclical upswings. However, it seemed to

be procyclical after the crisis, and the negative coefficient on credit growth suggested the narrowing pricing margin in cyclical upswings, thus supporting the accumulation of risk.

Finally, we investigated the delayed recognition and provisioning for non-performing loans (NPLs) and regulatory forbearance. We tested for effects of real GDP and credit growth on provisioning rate. Estimation results showed that provisioning was procyclical up until the crisis, while the negative coefficient on real GDP growth indicated less provisioning during cyclical upswings. In addition, the negative coefficient on real credit growth pointed out that provisions were not responsive to risk. However, the degree of procyclicality had decreased after the crisis because both real GDP and credit growth became insignificant.

Table 6: Real Credit Growth, Pricing margin, and Provisioning Rate

Independent variables	Credit growth		Pricing margin		Provisioning rate	
	Before crisis	After crisis	Before crisis	After crisis	Before crisis	After crisis
Constant	56.19***	107.18***	3.54***	0.04	-19.40**	???
	(0.00)	(0.00)	(0.01)	(0.81)	(0.04)	(0.00)
Macro indicators						
GDP growth	0.80***	-0.53	0.03***	0.00	-0.17***	-0.04
	(0.00)	(0.46)	(0.00)	(0.67)	(0.01)	(0.32)
Inflation	0.70*	6.22**	-0.88***	-0.87***	-0.11	-0.41***
	(0.08)	(0.02)	(0.00)	(0.00)	(0.57)	(0.01)
Real interest rate	0.48***	6.23**	-1.05***	-0.88***	-0.12	-0.65***
	(0.02)	(0.04)	(0.00)	(0.00)	(0.26)	(0.00)
Bank indicators						
Credit growth (-4)			0.00	-0.002*	-0.12**	-0.00
			(0.12)	(0.07)	(0.01)	(0.20)
Loan / Asset (-4)	-0.55***	-2.11***	0.01	0.011***	0.14	-0.06***
	(0.01)	(0.00)	(0.47)	(0.00)	(0.23)	(0.00)
Loan / Deposit (-4)		-0.09***	-0.009**	-0.0004**	0.20***	-0.00
		(0.00)	(0.03)	(0.02)	(0.00)	(0.27)
Pricing margin (-4)	0.38	6.66**			0.34***	0.34*
	(0.11)	(0.01)			(0.01)	(0.06)
Capital ratio (-4)	-1.14***	2.67***	-0.096***	0.00	-0.67***	0.01
	(0.02)	(0.00)	(0.01)	(0.16)	(0.01)	(0.53)
Bank dummy	Yes	Yes	Yes	Yes	Yes	Yes
Obs	119	424	145	319	119	319
Adj R-squared	0.705	0.6523	0.9989	0.9474	0.7734	0.6513

Source: Bank of Thailand, and authors' calculation

3. UP-TO-DATE DISCUSSIONS ON REGULATORY REFORM: WHERE THE WORLD IS HEADING TO?

To counter excessive procyclicality, the main objective of policy tools is to dampen the cyclical behavior and therefore serious volatility. However, *the total elimination of such cycles is clearly unrealistic and an undesirable goal.* Therefore, measures or interventions then aim at limiting

the amplification coming from risk management and incentive distortions. Success does not mean

regulators or supervisors having superior information than the private sector does. However, it does

imply overcoming the incentive problems faced by individual economic agents. In this section, we

intend to raise some key regulatory issues most relevant and most talk-about regarding procyclicality.

So far, you might learn that, to mitigate procyclicality, prudential measures should encourage

the accumulation of buffers during good times, which then can be drawn down during bad times. The

existing types of buffers are bank regulatory capital, loan loss provision and collateral arrangements.

Their roles as risk absorbers can be strengthened by a number of means. First**,** the concepts of

through-the-cycle volatility and forward-looking view should be integrated into risk management

policies and capital calculation (such as probability of default or external rating).[47] Second, *the*

buffers might be directly adjusted in order to smooth the cycles and, therefore, lessen the cyclical

variation (e.g. dynamic provisioning and countercyclical capital buffers such as using leverage ratio in

addition to the regulatory capital framework). Implicitly, the idea behind the implementation of the

adjusted buffer is that the difficulties in measuring, assessing, and managing risk are evitable for some

risk factors. Therefore, the next sections present the up-to-date discussions which are related to the

build-up of buffers in good time from many perspectives.

3.1 BASEL II; RISK SENSITIVE FRAMEWORK AND NON-RISK BASED MEASURE (E.G. LEVERAGE RATIO)

The current crisis revealed that risk-based capital requirement alone may not be enough to

protect the financial stability. While expressing an adequate capital ratio, many financial institutions

had built-up excessive leverage in off-balance sheet items. For this crisis, excessive leverage led to

more vulnerability in the financial system that would eventually have an adverse effect during cyclical

downswings when banks were required to de-leverage, thereby imposing additional stress onto the

financial market as well as exacerbating the cycles. Consequently, complementing the non-risk based

measures to the current capital framework so as to help limit the build-up of leverage might be

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[47] Normally, external credit ratings should be constructed to be through-the-cycle, but in practice they tend to
show more downgrades during cyclical downswings

reasonable.

Though conceptually sound, an introduction of leverage ratio into the existing risk-based regulatory framework of Basel II needs further study to be able to implement it practically. For example, the definition should be clear and well-aligned with the accounting standard. In addition, the implementation should take into account the differences of SA and IRB banks, as one size might not fit all. Another related concern is how to set the limit for such leverage. More importantly, the key concern for Thailand and many emerging markets might be the issue regarding regulatory arbitrage. In these countries, where banks are retail banks rather than investment banks, the portfolio structures of these banks tend to have proportionately more sovereign assets, while their off-balance sheet items tend to be non-market. The leverage ratio might not reflect the actual inherent risk of this kind of portfolio. To illustrate, the use of the binding leverage ratio may result in an increasing proportion of exposures to off-balance sheet items, such as guarantees that have not been recognized so far in leverage ratio, while it can also deter investments in low credit risk assets such as sovereign securities. Therefore, the entire portfolio can be riskier in terms of credit risk.

3.2 INCURRED LOSS MODEL (TRUE FAIR VALUE) UNDER IAS39 VS. EXPECTED LOSS MODEL UNDER BASEL II

As discussed earlier in the previous section, although incurred loss model under IAS39 might be suitable in terms of transparency and the ability to reflect the current market expectation, it also may have encouraged procyclicality. To curtail procyclicality, we will analyze alternative approaches which incorporate a broader range of available credit information, while providing the necessary transparency.

Alternative approaches of the current incurred loss model are fair value models, expected loss models, and dynamic provisioning. Although on one hand, *the fair value model* might succeed in recognizing the losses early and incorporating a broader range of credit losses when compared to the current "incurred loss" model of IAS 39, it is highly possible that it may exacerbate the cycle because, as mentioned above, fair value is not a useful approach during the adverse market condition when some markets collapse, thus valuation highly depends on the subjective process.

A more reasonable measure is *the expected loss model*, as it corresponds to bank risk management. More importantly, in our opinion, this is where the world is heading to. It may resolve the conflicts between the current Basel framework and the existing accounting standard. The discrepancy between accounting rules and regulatory standard can have a significant effect in terms of valuation, resulting in comparability and reliability. However, the downside of the model is that this risk management model varies with the level of bank complexity, because banks have to not only collect the data to forecast expected cash flow and expected loss but also enhance their capability to handle their own complexity. As a result, the estimates may be unreliable and highly dependent on the quality of the data which can be manipulated.

The last alternative approach involves *dynamic provisioning*.[48] According to Mann and Michael (2002), dynamic provisions refers to provisions that are set against loans outstanding in each accounting time period to be in line with an estimate of long-run expected losses. Generally, the level of provisioning on this basis will be less subjected to sharp swings from economic activities than the current approach. Such idea has been implemented in Spain since 2000. The current crisis helped support the use of dynamic provisioning. According to Saurina and Jesus (2009), dynamic provisions have contributed to the stability and have allowed Spanish banks to cope with the crisis from a much better starting point. However, this model is very technically challenged to implement. It goes to show that the trade-off between efficiency and complexity always exists.

3.3 THROUGH-THE-CYCLE AND FORWARD-LOOKING

One of the root causes from the crisis regarding risk management involves the applications of the underlying models. For example, the VaR methodology can potentially encourage banks to increase their risk appetite during the boom, or amidst the low-volatility environment, and reduce it during the bust or in a high-volatility environment, increasing cyclicality. This can be attributed to the underlying assumptions of VaR models under the market and credit risk framework of Basel II, as

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[48] From Mann and Michael (2002), dynamic provisioning is that provisions that are set against loans outstanding in each accounting time period in line with an estimate of long-run expected losses. Generally, the level of provisioning on this basis would be less subject to sharp swings stemming from the strength of economic activity than the current approach.

mentioned in section 1.2. Although we have not seen any specific proposals that integrate the through-the-cycle and forward-looking concepts into the regulatory framework, we would encourage not only the supervisors and regulators, but also the private sector and banks to realize the importance of such concepts. To promote such thoughts, first of all, risk management models should be tailored-made to an individual firm's characteristics, although this can possibly bring about the complexity and burden on the banks. Therefore, banks should carefully consider and find the appropriate balance on the model.

The regulatory capital requirement is not the only source that should incorporate such concepts. As discussed earlier, there are a number of the existing types of buffers; bank regulatory capital, loan loss provision, and collateral arrangements. After touching upon the first two types of buffer, we would like to elaborate on the last type of buffer. Collateral arrangements might be related to *property* for mortgage loans or *margin requirement and haircut* for securities and derivatives. The BOT does realize the importance of both through-the-cycle and forward-looking concepts and has implemented some counter-cyclical mechanism upon this last buffer to ensure the Thai financial stability. For mortgage loan, BOT has set the loan-to-value limit for the high-end real estates back in 2003. In addition, BOT has tightened regulations on the credit card business in 2004. In 2005, BOT has adopted the personal loan measures. Such regulatory statues by BOT might be partly responsible for the anti-cyclical consumer credit behavior presented in Section 2.2, which helped, to some certain extent, the Thai financial system from being directly impacted by this financial crisis.

The main difficulty in implementing either the through-the-cycle and forward-looking concepts or even counter-cyclical measures is that, during the good times, these measures will always be unpopular. During the boom, everything looks well and agents will be confident in the economic outlooks. So they tend to underestimate the likelihood of high-loss but low-probability events ("disaster myopia", Guttentag and Herring (1984)). Therefore, the implementation should be *rule-based* and can be introduced during bad times when such implementation will gain sufficient approval and be proved to be imperative.

3.4 THE BIG HINDRANCE

A number of policies are proposed in order to encourage the accumulation of buffer in good times. The accepted wisdom is that this would act like a shock absorber during the stressed period, and might also hinder the growth of risk-taking behaviors during the expansion period. Unfortunately, though theoretically sound, it may not be realistic. Such policies come with inherent problems because the reversion of capital regime is based upon where the economy currently resides in the cycle, while no one can reliably predict business cycles, with limited information and a lot of false signals present. Therefore, further researches are needed to make those proposals practical.

III. APPROPRIATE REGULATORY ARRANGEMENT AND BANK GOVERNANCE

In this part, three issues regarding the appropriate regulatory arrangement for Thai financial system will be examined. These issues are: (i) cautious approach to financial innovation; (ii) consolidated supervision and the importance of functional and cross-border supervisory coordination; and (iii) mitigating the regulatory cycle; and (iv) bank governance and compensation scheme. In each topic, we also summarize the policy options and outline remaining challenges.

1. CAUTIOUS APPROACH TO FINANCIAL INNOVATION

Another key cause of this crisis is an inconvenient truth about how *financial innovation did outpace risk management*. The belief that financial innovations could serve the increasing demand of investors and could be used as instruments to diversify risk led to the creation of financial sophisticated products. Examples of these products are securitization and structured credit derivatives, particularly collateralized debt obligations (CDOs) and collateralized debt securitization (CDS) through the unregulated over-the-counter derivative market (OTC). These instruments promised higher yields with lower risk to the investors. Unfortunately, this innovation had underestimated the underlying risk and, together with imprudent risk management, led to financial institutions having too-high leverage level. In turn, this increased the vulnerability in the system which, as we all know, finally spread globally. This crisis lesson illustrates not only the potential

negative side of financial innovations but also the failure to assess the true level of risk associated with them by regulators and relevant parties, including rating agencies and investors.

1.1 WHAT IS BEING DISCUSSED AND WHY WE SHOULD BE READY

According to the G20 working group (2009) on enhancing sound regulation and strengthening transparency, an increase in the complex and opaque financial products was one of the root causes of this subprime crisis. The G20 report also stated that one of the medium-term action plans to enhance sound regulation was to ensure that the regulators and policy makers were aware and able to respond in a timely manner to potential complications from financial innovations.

At present, Thai financial institutions have only limited exposures to these complex products compared to other financially developed countries. This is because the Thai financial intermediation is bank-dominated whereas equity and bond markets still need to be deepened and broaden. Since the Asian crisis, the use of securitization and derivatives was lower in Asia than in Europe and North America (ADB 2008). Moreover, the development of complex-structured products, especially derivatives and swaps, as well as hedging activities also lag behind major financially developed countries.

However, this does not mean that Thai policy makers should be complacent about this issue. With the potential change in the Thai financial landscape mentioned in Section I, the development of new and more complex financial products is most likely to happen. The appropriate action to be taken by Thai policy makers is to apply policies, currently done at the micro level, in order to *balance well between the efficiency gain from innovations and the well-known importance of prudential risk management.* At present, the BOT has implemented regulations with the goal to achieve this appropriate micro-level policy, which will be discussed in the next section.

1.2 THE ACTIONS TAKEN BY THE BANK OF THAILAND

Since the Asian crisis, the BOT has moved cautiously toward issuing policies with regards to financial innovations. Originally, the permission was generally granted for only plain vanilla derivatives—the basic derivatives with the simplest structure. Should an institution wish to conduct

other complex derivative contracts, so called "exotic products," it must seek approval from the BOT on a case-by-case basis. However, beginning in 2005, the BOT expanded its permission scope to support more financial innovations and assist commercial banks with their hedging activities. Banks could undertake structured derivatives transactions in which the reference variables were interest rate, exchange rate and financial indices such as packaged vanilla derivatives, barrier derivatives and digital options. All the transactions, however, must be within the framework set by the BOT (BOT Notification, 2005). In addition, to further enhance the efficiency of derivative markets, reduce costs as well as increase the competitive advantage for banks, the BOT did expand the scope of permitted structured derivative products as well as credit derivatives initiated by commercial banks in 2008. With this new measure, commercial banks are now permitted to undertake new types of structured derivatives such as hybrid derivatives.[49]

Apart from expanding the permission scope, the BOT also aims at promoting sound risk management—especially on the understanding of the true underlying risk embedded in these products by all parties involved. Consequently, commercial banks must comply with all the related regulations and prudential guidelines set by the BOT. The requirements consist of: (i) suitability and adequacy of the underlying; (ii) single lending limit; (iii) capital funds for counterparty risk; and (iv) capital holding for market risk (BOT Notification, 2005). Meanwhile, commercial banks must adhere to five key principles in relation to their risk management (BOT Notification 2008):

1) Banks must efficiently manage risk arising from credit derivatives and are subjected to BOT prudent rules of conducts to ensure good practice and efficient risk management.

2) Commercial banks must not undertake derivative transactions that impose any negative impact on the stability of financial system.

3) Commercial banks are required to prepare sufficient documentation as evidence of transactions for examination purposes. The information must be reported in compliance with the BOT standards.

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[49] Hybrid derivative is the derivative which combines more than one feature of derivative from different market such as interest rate and exchange rate.

4) Commercial banks must provide truthful and complete information regarding characteristics and risk of derivative products to customers.

5) Commercial banks must comply with all other relevant prudential regulatory requirements.

These regulatory guidelines illustrate that the BOT not only move toward enhancing the depth and advancement of the financial market, but also exerting caution on potential risk associated with complex financial instruments.

1.3 BENEFITS OF THE CURRENT REGULATION IN PLACE

The regulatory benefits from the BOT supervisory framework on structured derivatives can be summarized into four possible categories. First, we believe that *risk arising from structured products will be monitored, assessed and managed effectively* with the current BOT guidelines. With the revised notification (2008), commercial banks are required to prepare "product program"—the report containing necessary details of structured products as well as the risk management plan that reflects complete and clear information regarding the products. Likewise, the BOT regulations have been continuously amended to keep up with the rapid and dynamic pace of financial innovations. This nature of policy issuance should help reduce risk and mitigate uncertainties in the system in a timely manner

Second, the BOT notification will *help raise awareness and improve the coordination and accountability among relevant parties, particularly the board of directors*. Referring back to the subprime crisis, even the most sophisticated investors, professional credit rating agencies as well as regulators, found it difficult to assess to what extent they were actually exposed to the risk embedded on structured financial products. With the revised BOT notification (2008), financial product providers, especially the board of directors, must understand the complexity of the structured derivatives they wish to undertake. Moreover, efficient risk monitoring and management will become the board of directors' responsibilities, given that they are required to comprehend the nature of complex financial services before approving and launching them into the market.

Third, since the growing financial innovation can increase the size of potential risks which can be transferred to households (OECD, 2008), the BOT guideline was *designed to also protect consumers and investors*. The revised guideline was done to address the problem of asymmetric information—some market participants having information than others—in an environment of rapid financial innovation, which had contributed significantly to the onset of the U.S. crisis (Mason, 2009). Regarding the good practice requirement in the guidelines for financial institutions, consumers will be better protected and more informed on the risks and complexity of structured products they may choose to engage. Since the function and underlying risk of complex instruments are somehow difficult for consumers to understand, the BOT requirement for the full disclosure on product information will not only prevent financial service providers from taking the opportunity to increase their profits via asymmetric information but also help individuals to better understand the benefits and risk of the structured products, thus enabling them to make informed investment decisions.

Finally, as for the derivative information disclosure criterion, the BOT also requires an improvement on transparency of information disclosure. *Regulators will be able to evaluate risk on complex structures* as well as their impact and thus can oversee the risk management more effectively and efficiently, while being able to detect and mitigate any threat and uncertainties driven by the underlying risk of these products in a timely manner. In summary, the actions taken by the BOT are as follows:

Table 7: Summary of the Regulatory Approach by the BOT

Criteria	U.S. weakness on innovation	BOT cautious approach on innovation
Regulation on innovation	• Poor risk management on structured financial products (such as CDO, CDS)	• Prior approval from the BOT on complex structured derivatives to ensure complete understanding on underlying risk of the products • Enhancing risk management on innovation
Board of directors' responsibility	• Board of directors were focus on profits rather than exposure on risk of innovation	• Building awareness on Board of directors in term of monitoring and approving innovation as well as managing its risk
Consumer protection	• Lack of knowledge and data about complex products • Asymmetric information between providers and clients.	• Important information regarding innovation must be communicated to individual investors
Data disclosure and transparency	• Lack of transparency especially in OTC market.	• Requiring improvement on transparency and sufficient disclosure of data

1.4 CHALLENGES AND POLICY IMPLICATIONS

Even if regulators may try their best to detect and manage risk stemming from complex financial products, the innovations which entailed financial instability will still be created and

potentially evolved into different and even more complex forms. To make matters worse, financial service providers might try to find regulatory loopholes in those less-supervised financial sectors, or so-called "regulatory arbitrage," which will be discussed in the next section, so as to introduce innovations to those markets for higher yields with low cost.

To cope with these challenges, not only the prudent regulations need to be strengthened and developed to keep up with the innovation pace, but also *the Thai regulators, as well as related parties, should understand and identify innovation-related risk at an early stage*. The failure to do so will lead to insufficient risk monitoring and inferior risk management which can consequently lead to additional instability in the system. Therefore, the challenge here is for regulators to be well-prepared for this fast changing financial environment by improving their skills and understanding of the dynamics that drive technological-based innovation. The training of regulators should enable them to conduct the complete characteristic analysis and assess true risk exposures of structured financial products, both in normal and distress time. In addition, they should be aware of any potential attempt to exploit regulatory arbitrage in sectors less supervised so that their risk profile assessment can be made most complete.

The existence of asymmetric information between sellers and buyers of financial products is another challenge. Should this asymmetric information persist, one of the key tasks for policy makers is to protect consumers by imposing further *the up-to-date code of conducts for financial service providers so as to minimize or internalize externalities from this information asymmetry*. In addition, investors should be encouraged to understand the nature and risk associated with these complex products. Creditor's rights as well as related legislations should be enhanced to curtail unethical practice and fraud so as to ensure further consumer protection. Meanwhile, *all vital information regarding new sophisticated products must be included in the report for more efficient risk assessment*. In relation to this, regulators will need to *promote the independence and integrity of credit rating agencies, as well as information disclosure on their rating methodology*. This is important because, from this subprime crisis, even famous credit rating agencies did underestimate, by a large amount, the underlying risk when issuing ratings for structured products, and consequently contributing in a significant way to the onset of the crisis.

Finally, derivatives trading, especially over-the-counter (OTC) derivatives in Thailand, is still in an early stage. However, we perceived that the OTC activities will likely expand due to more financial liberalization and competition in the future and the level of complexity in OTC derivatives may increase rapidly. Inadequate comprehension of the derivative structure and insufficient monitoring on the OTC derivatives will be dangerous, as can be seen from the U.S. case. Therefore, promoting the understanding of derivatives among stakeholders and enhancing greater data transparency are needed going forward. Likewise, authorities should set guidelines for better and more thorough oversight and for improving transparency of OTC markets, participants as well as instruments to ensure that excessive leverage, mentioned in Section II, and risk do not accumulate in the financial system.

2. CONSOLIDATED SUPERVISION AND COORDINATION

Another essential cause of the U.S. crisis acknowledged by the G20 working group (2009) was the lack of oversight for unregulated pools of capital and institutions seeking "regulatory arbitrage"—an incident where a financial entity aims at taking advantage of differences in regulations between banks and non-bank financial institutions (NBFIs). Subjected to milder regulatory framework than depositary banks, various types of less-regulated NBFIs in the U.S. were created, notably structured investment vehicles (SIVs). These investment vehicles often financed their operations without the minimum capital requirement or sensible liquidity plans or both. Thus, they possessed an enormous amount of off-balance sheet leverage and created vulnerability in financial system through mechanisms discussed previously in Section III. In our view, there are ways to minimize this regulatory arbitrage, namely through the implementation of consolidated supervision framework and close coordination among supervisors.

2.1 WHY CONSOLIDATED SUPERVISION NOW?

Even though the problem regarding regulatory arbitrage does not appear to be the main concern in Thailand at the present time because of the improvement in regulatory and supervisory regime after the Asian crisis, together with limited roles of NBFIs and financial conglomerates, Thai

policy makers cannot be complacent about this. The more competitive and liberalized financial landscape in the future may result in the establishment of larger and more complex financial conglomerates that will provide a full range of financial services. Unless there exist well-regulated supervision and coordination among regulators, undue risk exposures can arise for banks with their universal banking activities (IMF, 2009). In addition, technological advancement in the financial know-how should mean that the risk transmission across financial sectors through structured derivatives, securitization and other complex financial products will be stronger. Consequently, banks and non-banks, as well as cross-border financial institutions, will be more financially linked. This environment will make the issue of regulatory arbitrage very crucial, as this "unleveled playing field" means that risk taken by the less-regulated entities can easily spread to and will be born by other players in the financial sector, while increasing the system instability as a whole.

**Figure 18: An Evolution of Financial Supervision Approach**
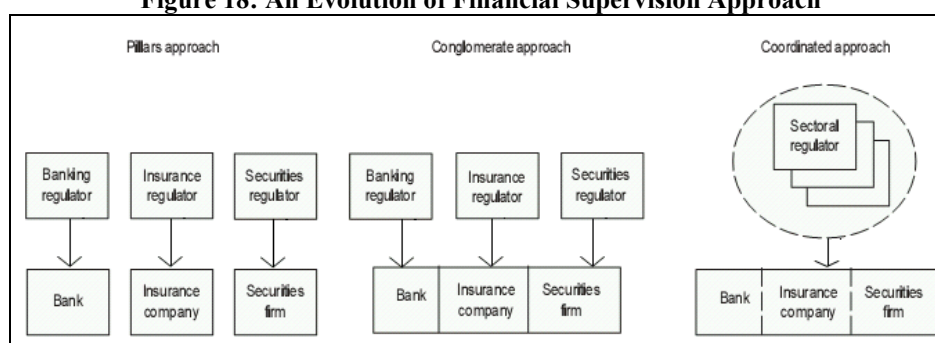
Source: OECD

To deal with this challenge, policy makers should plan in advance the prudential supervisory framework that can mitigate the incentives of institutions seeking regulatory arbitrage and minimize the risk coming from the more-integrated financial system and complex financial conglomerates.

In this regard, many countries around the world have prepared themselves to handle the problem that may occur from financial conglomerates and more-connected linkages among sectors on a consolidated basis (Gosh, 2005). With this consolidated framework, financial groups, particularly non-bank financial institutions, will be supervised under the group-based regime, so that regulators can have a more complete view in assessing the overall performance of such financial group.

2.2 THE BANK OF THAILAND'S REGULATION

After the Asian crisis in 1997, the structure of the Thai financial system has constantly been transformed. From the following figure, in 2007, NBFIs, especially mutual funds, insurance companies, pension funds and specialized financial institutions (SFIs), played an increasingly important role in the system, even if the system was still bank dominated.

Figure 19: Financial system structure in Thailand
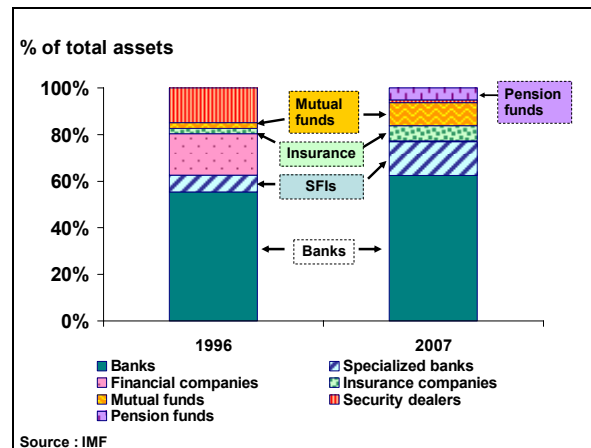
Given the upcoming era of large financial conglomerates, together with an increasing role of NBFIs, the consolidated supervision among financial institutions will be an essential tool to promote the stability and efficiency (by means of internalizing externalities) of the more-integrated financial system. In addition, the consolidated concept will lead the supervisory framework regarding complex financial conglomerates to be in line with the international standard.

Figure 20: Regulations regarding Consolidated Supervision
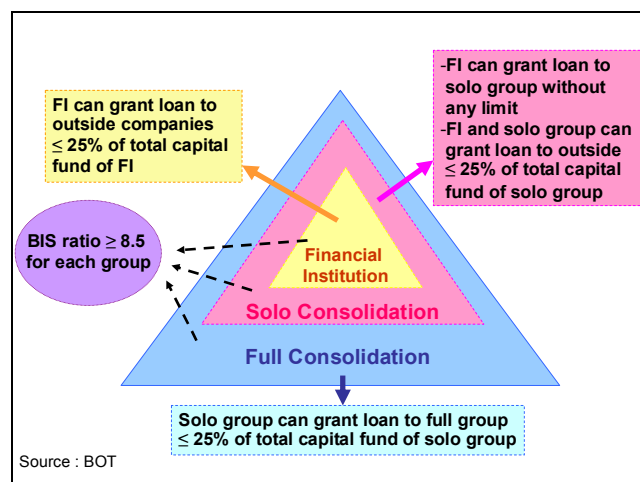
In this regard, the Bank of Thailand acknowledged the importance of this issue and, thus, introduced the guidelines on such consolidated supervision in the Financial Institution Business Act B.E. 2008. This consolidated framework was adopted to mitigate regulatory arbitrage as well as to provide support for the possible development toward financial conglomerates that integrate banks, insurance, asset management and investment banking under one roof. The legislation was approved by the Ministry of Finance (MOF) and has already been in effect since 2008. The full implementation of the consolidated supervision framework applied to all relevant financial institutions shall be completed in 2011.

Under consolidated supervision, the BOT will be legally empowered to supervise both the financial group whose parent company is a financial institution and the financial group whose parent company is a juristic person which is non-FI. Under this consolidated basis, an establishment of a financial group as well as the structure of shareholders will be considered and approved by the BOT, in accordance with the consolidated supervision guideline. Moreover, financial groups, particularly those previously unregulated, will be evaluated based on both the qualitative and quantitative basis, so as to assess the risk that can potentially arise from the activities of the financial group as a whole. According to this regulation, the overall financial performance of the financial group will be reviewed on both the consolidated and solo basis, along with the performance of each individual entity. Finally, the BOT will also monitor the large individual exposure limit and the intergroup transaction limit as a part of the policy to best supervise and ensure stability for whole financial group.

The implementation of the consolidated supervision statue will help stabilize the financial system in many ways. First, since a trend toward financial conglomerate can potentially drive risk taking behaviors by financial institutions whose risk monitoring and assessment have become more complex (Nier, 2009), this framework combines the prudential regulation and code of conduct for the financial group into one package, thus reducing redundancy and leveling out a regulatory playing field across sector under one financial umbrella. Consequently, it helps mitigate the urge for intuitions to seek regulatory arbitrage cross sectors.

Second, the consolidated supervision will allow regulators to be able to understand, monitor and assess non-categorized products, as well as other types of risk coming from the activities

conducted by financial conglomerate, more effectively. Meanwhile, with the legislation that limits

the size of loan issuance to a single obligor (so-called "single-lending limit") and the size of

intergroup transactions, the problem of risk concentration will be addressed and mitigated. Finally, fit

and proper standards for shareholders, especially managers and board members, have been

determined. This criterion will ensure that board members have the sufficient skills and appropriate

qualifications to operate a particular financial institution.

2.3 POLICY IMPLICATIONS AND REMAINING CHALLENGES

Although consolidated supervision aims at promoting stability of the Thai financial system,

not all financial entities are a part of this framework. At present, the BOT does not have the legal

authority to perform the consolidated supervision on the exposures of banks on their insurance or

securities business (IMF, 2009). With increasing roles of insurance companies, security firms and

foreign banks in the financial system, the clear distinction between these entities and banks will

gradually decrease. As we learned from the subprime crisis, the growing linkages and complexity in

the financial market could lead to severe volatility in the whole system. Therefore, one of the

effective solutions to close this existing regulatory gap is to have close coordination not only between

private sectors and regulators but also among regulators both nationally and globally.

First, to promote stronger coordination among regulators nationally, *regulators must*

understand now different types of financial institutions are linked and then engage in information

sharing, especially on the level of risk transmissions across different types of financial entities.

Second, it is also important for the Thai regulators to coordinate with supervisors in other countries.

With globalization, a tendency of having financial firms with international operations is significantly

increasing. This globally integrated financial market carries with it a troublesome nature in a sense

that risk can be transmitted more quickly to other financial markets around the world.

Therefore, the challenge for policy makers and supervisors is *to find the right balance*

between promoting the cross-country businesses as well as enhancing efficiency of regulatory and

supervisory framework. It is worthwhile for Thai regulators to coordinate with other supervisors,

particularly with systemically important financial institutions, so that cross-border financial risk and

constraints will be well managed. Moreover, with an initiative of the cross-border coordination between the central bank and foreign counterparts, such as through MOU, the cross-border regulatory framework of the financial market will become a crucial element in cross-country systemic risk mitigation. Under the current circumstance, we have to bear in mind that the achievement of financial stability does not only depend on the national policy framework, but also requires close coordination internationally as well.

3. REGULARTORY CYCLE

Another interesting regulatory weakness that helped exacerbate the subprime crisis is the nature of what is called the "regulatory cycle," when supervisors tend to under-regulate during good times and over-regulate during bad times. This can be seen by a breakdown in underwriting credit standards, particularly in the U.S. mortgage market. Before the crisis, the U.S. had a long period of abundant liquidity as a result of large capital inflows from more saving countries, such as Asia and oil producing ones. Flux of foreign capital inflow, combined with favorable macroeconomic conditions and low interest rates in a long period, generated a rapid growth of credit expansion. With highly competitive environment among lenders leading to the lax of underwriting credit standards, more loans were introduced to high-risk borrowers whose ability to repay was virtually inexistence.
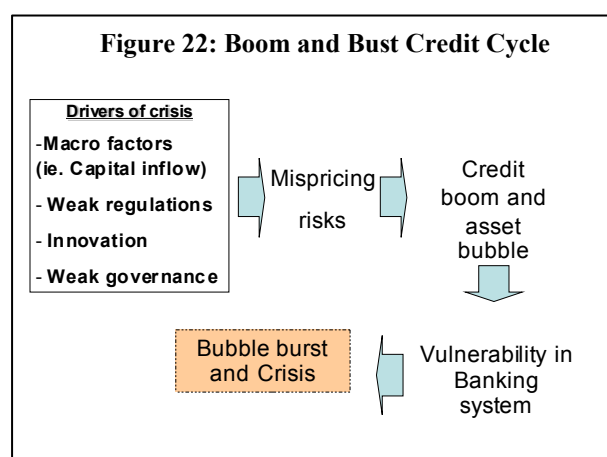
Figure 21: Asset Compositions of U.S. commercial banks

Source: Board of Governor of the Federal Reserve System
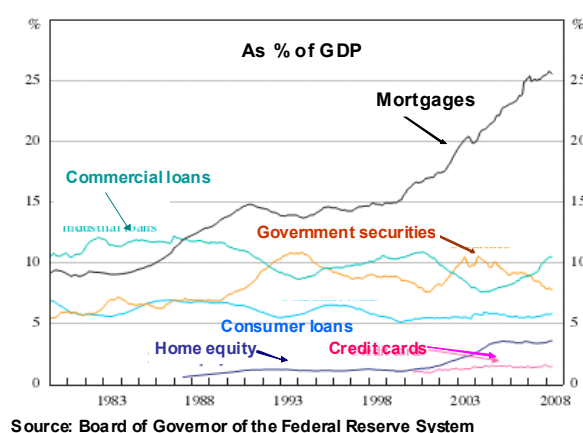
To elaborate more, new kinds of mortgages loan contacts, notably the "No Income, No job and Assets" (NINJA) loans and adjustable-rate mortgage rates, were offered to attract borrowers,

regardless of their financial constraints. Consequently, subprime mortgage grew rapidly and led to the bubble in real estate prices. The U.S. housing market had slowdown since 2005 (OECD, 2008), as the harsh reality of hidden leverage and credit risk, which had accumulated over the good years prior, surfaced. Therefore, delinquencies on subprime mortgages rose rapidly before the default created a spillover to other sectors of the U.S. financial system and around the world.

Although every past financial crisis seemed different in some aspects, almost all crises shared similar causes. Boom and bust credit cycles that occurred in the subprime crisis was nothing new. It has been a root cause of many crises, including the Asian Banking crisis and Japanese asset bubbles. Following the lesson learned from the subprime crisis and also the past crises, major causes of serious banking problems were directly related to lax credit standards for borrowers and counterparties, poor portfolio risk management as well as being unaware of changes in circumstances that led to the default by a bank's counterparties during the business cycle upswing. In this situation, poor underwriting credit standards could lead to credit risk exposures that would deteriorate stability of financial system. The BCBS (2006) also mentioned that a major cause of bank failures could be attributed to poor credit quality and credit risk assessment.

Figure 22: Boom and Bust Credit Cycle

As such, there have been discussions among supervisor regarding this regulatory cycle nature. The under-supervision during the economic upturn can lead to the failure in identifying the potential deterioration in credit quality in timely manner, while the excessive-supervision during the downturn period can slow down the much-needed economic recovery. Furthermore, as stated earlier in Section II, credit risk tends to be procyclical with the economic cycle, as underwriting credit standards tend to be lenient during the favorable time as a result of economic expansion whereas tend to be tightened during the distress time. Therefore, underwriting standard must be maintained at all times to mitigate this cyclicality effect.

3.2 REGULATORY CYCLE AND THAILAND FINANCIAL SYSTEM

In light of the analysis above, the BOT has taken steps to mitigate such regulatory cycle. With a keen awareness that credit risk is a main source of risk for Thai banks, the BOT set the guidelines for financial institutions to ensure that financial institutions have efficient credit risk management at all times, regardless of where the economy resides in the business cycle. With specific characteristics, complexity and volume of loan contracts, each financial institution is likely to have different degrees of credit risk. The BOT guidance for financial institutions has the purpose of encouraging banks to develop the credible loan origination process. With this framework, the BOT encourages an individual financial institution in setting the credit approval procedure in such a way that it can be done carefully and thoroughly so only qualified obligors will get access to the loans they deserve. In this process, several criteria of credit decisions, such as qualification of borrowers, repayment conditions and credit limit will be examined. Meanwhile, financial institutions will be supervised on the efficiency of their risk management, especially on loan portfolio management, while taking into account the risk concentration and risk from related lending to ensure possible types of risk are incorporated into the risk assessment framework.

Moreover, to cope with the potential lax in the underwriting credit standard during the good times, the BOT strongly encourages financial institutions to develop a risk assessment tool called *credit scoring*[50] to be used at all times as a part of the risk management policy for the retail loan portfolios. With this credit scoring system, credibility of borrowers will be assessed based on customer information and historical payment profiles. Not only should credit scoring be applied to new loan approval, but it should also be used to manage retail loans in other aspects as well; for instance, monitoring losses and debt collection (BOT Notification, 2005). With its objectives to distinguish between good and bad accounts and assess the probability of default based on the assumption of past characteristics and behaviors of borrowers, regardless of the economic environment,[51] credit scoring is considered to be an example that reflects the BOT's effort to mitigate

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[50] Referring the BOT Notification No.227/2548, a definition of credit scoring is a system which assist risk measuring and managing of retail loan portfolio of financial institutions by calibrating information related to nature and behavior of customer to sectors by analyzing and compiling related statistical from historical data.
[51] BOT Notification regarding guideline for risk management practices, 2005

regulatory cycle. This means that loans will be well monitored and managed over the cycle, not just during the bad time.

Other important regulatory moves related to mitigating regulatory cycle are the loan classifications, which are closely tied to the level of *provisioning* required on banks, and the implementation of IAS39 accounting standard. These BOT's policies were implemented in 2006, supposedly the good times of the Thai economy, to ensure that banks had sufficient provision for the good economic period as well. The revised loan classification led to banks having to hold more provision on the 'doubtful' and 'suspected loss' classes of obligors, when compared to the previous regulation. In addition, other counter-cyclical measures implemented by the BOT had already been discussed in Section II. Recall that these specific preventive measures are the loan-to-value ceiling for high-end real estate, raising minimum requirement on credit card loans and personal loans. With these regulation revisions, the BOT ensures that the credit underwriting standards remain consistent at all times and hence maintains regulatory prudence throughout the business cycle.

3.3 CHALLENGES AHEAD

Having said earlier, credit booms and busts have long been considered a repeated root cause of financial crises in the past. Once the global economy recovers from this distress time, the surge of capital flow to emerging countries may occur once again. With all the lessons we have learned and experiences we have accumulated, we foresee that a classical building up of financial imbalances that will lead to credit expansion is inevitable. Because of this persisting pattern in the nature of credit issuance, credit quality and risk assessment need to be maintained at all times. This becomes an important task for regulators to supervise financial institutions so as to ensure that banks should have sufficient capital holding to cover for not only the current risk but also other types of risk that will evolve in the near future. The forward-looking assessment of such emerging risk will become a challenge to both supervisor and financial institutions, as it will not be easy to forecast and detect new risk imposed onto the system and institutions.

Another obstacle in mitigating regulatory cycle, and implicitly credit underwriting standards, is the difficulties in identifying where the economy resides currently in the business cycle. The debate

of the average length of a business cycle can range from five years to ten years, not to mention that the nature of the cycle will be different across countries. In order to make a good inference as to where we are in the cycle, one will need to understand well how the business cycle in Thailand and the Thai economy behaves. However, one sure way to cope with this difficulty is for regulators to keep the guard up at all times, even during the seemingly good years.

4. CORPORATE GOVERNANCE AND COMPENSATION

The recent financial crisis has drawn attention also to the issue of bank governance. One important factor, among many, which is related to governance practice regards the executive compensation policy. Compensation schemes were widely claimed to have contributed to the recent financial crisis. This is because many financial firms rewarded their management based on the non-risk-adjusted short-term performance. For instance, top management's compensation might rely significantly on short-term profit made or stock prices, without taking into account the medium-term or even longer-term horizon of business prospects and the consequences of their risk appetites. This compensation setting was not different from the compensation of traders, who sought to profit from the short-term volatility in the market. These incentives and risk-taking behaviors could severely threaten the financial system as mentioned earlier. This lack of attention to risk thus calls for official measures to ensure that there is no misalignment between risk-taking incentives and compensation.

For Thailand, the problem regards the executive compensation structure of local bank management is likely to be moderate, since it mainly relies on basic salary and relatively small performance-based bonus. However, traders for derivatives (or investment banking personnel) are paid based on the values of transactions and products. These can potentially lead to extra incentives to sell unnecessary products to end-users.

4.1 HOW TO DEAL WITH COMPENSATION SCHEME?

Regarding the compensation issue, BCBS, in its *Enhancement to the Basel II Framework* issued in July 2009, provided the guidelines for the alignment of compensation with prudent risk taking aiming to minimize the incentives for excessive risk-taking motivated by the compensation

scheme. The essence of this guideline includes: (i) raising awareness of the board to integrate associated risk into compensation policy; (ii) considering the whole time horizon of risk before issuing executive payments; (iii) reviewing banks' compensation practices in the regular risk assessment process by supervisors; and (iv) disclosure of essential information on the bank's compensation practices to all stakeholders.

As for Thai banks, the BOT pays a close attention on financial institutions that excessively provide compensations to the board of directors and senior management when compared to their peers. The BOT also encourages commercial banks to have a "compensation committee" embedded in the bank structure to review and approve the compensation package of the bank's board of directors and executive officers. In addition, employees' compensation policies are also investigated to ensure that risk components are incorporated appropriately. In mid 2009, the BOT issued the revised guideline on bank directors' roles and responsibilities to ensure that executive compensation does not unduly rely on (non-risk adjusted) short-term profits.

4.2 CHALLENGES AND POLICY IMPLICATIONS

The issue of compensation scheme for bank management can create another concern going forward. As the economic recovery is in order, the banking system will likely resume a flourishing business again. This may prompt the head-hunting process for skillful management personnel and fire up the competition to well-compensate potential candidates. Therefore, the remuneration schemes need to be monitored and managed sufficiently. To deal with these challenges, some policy implications have been raised as follows.

First, an objective of remuneration scheme of commercial banks should be encouraged to focus on a long term performance rather than short term profits. The senior supervisory group (2008) stated that sufficiently well-designed compensation scheme should be encouraged to achieve an appropriate balance between risk appetite and risk control, between short run and longer run performances and between individual goals and firm-wide objectives. Consequently, an awareness of potential incentive distortion arising from the ill-designed compensation scheme should be raised.

The aim is to provide incentives for bank managers to maximize not only shareholder's welfare but also total firm values.

In setting the better remuneration framework, both the authorities and relevant entities may need to provide guidelines or leadership that will encourage financial institutions to implement the compensation framework that is free of excessive short-term risk taking and focuses more on the risk-adjusted long-term performance. Moreover, an excessive incentive fee that depends on the short-term performance, such as stock options or shares, should be converted to a long-term incentive that concentrates on the value of the firm in order to retain qualified board of directors, executives as well as employees.

Secondly, the process of setting the remuneration framework should be transparent to shareholders. Meanwhile, the disclosure of the directors' compensation process should be encouraged. To achieve this, all the essential information regarding remuneration scheme, such as the characteristics of directors' performance related compensation, degree of risk adjusted to remuneration, as well as other measurable standards, should be disclose to stakeholders. Moreover, the component of fixed and variable compensation should be cautiously considered by the board of directors and shareholders without any conflict of interest. Finally, the compensation scheme should be fair and adjustable by shareholders so as to create a well-design structure of the banks' compensation framework.

Finally, the non-executive incentive should also be taken into account. Although traders' compensation might not be an area of concern so far, because derivative trading is still in an early stage, more financial liberalization as well as competition may lead to a more important role of derivative traders and investment banking personnel in the future. Due to transaction-based incentives, traders or other non-executives employees can cause corrupt practices against a bank's policies and interests (OECD, 2008). As a result, the suitable compensation scheme for traders also should be another concern for banks and relevant regulators. To efficiently assess risk arising from short-term based or transaction-based compensation, supervisors should possess the ability to better understand and monitor risk associated with the incentives and behaviors of traders as well.

CONCLUSION

From the recent U.S. financial crisis, economists, policy makers and central bankers had to again find out what had gone wrong and explore possible policy-related issues that might have played a part in the onset of the crisis. Our study focused on the key bank supervisory-related issues that are most relevant to Thailand. These issues are: (i) financial linkage and systemic risk assessment; (ii) procyclicality of the financial system; and (iii) appropriate regulatory arrangement, bank governance and bank executive compensation.

Regarding the issues on systemic risk and financial linkages, we presented the results from Roengpitya and Rungcharoenkitkul (2009), which showed that Thai banks imposed, during crisis time, onto the system additional risk that could not have been detected from considering the institution's stand-alone value-at-risk (VaR). In addition, using the data from the post-crisis period, the contribution to the system VaR varied by types of institutions. Using this findings, we recommended that, although the current regulatory statues may have somewhat addressed the risk of an institution's VaR and partly the system's VaR through the implementation of various regulatory statues, additional supervisory requirements are needed to internalize potential negative externalities that financial institutions may potentially impose onto the system during distress time.

By nature, the financial system exhibits procyclicality. The source of such procyclical behavior comes from both the tendency of economic agents to misperceive risk—underestimating it during the upturn of the cycle and overestimating it during the downturn—and the existing regulations that may have helped amplify such procyclical movement. Using the credit growth data, we found that the Thai financial system exhibited the strong procyclical nature prior to the Asian crisis. However, when investigating further by types of loan originations, we discovered that the procyclicality nature depended strongly on asset classes. The consumer credit demonstrated even the anti-cyclical behavior while the corporate loan seemed to be more procyclical. We recommended that, in order to craft the policy to mitigate this procyclical effect, policy makers will need to consider, among other things, the types of loans and appropriate instruments that will make it happen.

When it comes to financial innovation, we suggest that it should be approached with caution and those parties involved should understand and manage well the true underlying risk of such

instruments. In addition, consolidated supervision is an effective way to cope with regulatory arbitrage and enhance the fair playing field among financial institutions, thereby taking into account any negative externalities that may have been previously left out. Last but not least, we have also shown that Thai supervisors did mitigate the regulatory cycle after the Asian crisis, which brings about the soundness of the lending practice and minimizing the impact of U.S. crisis on the country. Lastly, we have outlined the up-to-date discussions on bank governance and executive compensation to hopefully bring awareness of what can be done to improve upon both aspects.

We do hope that this study will provide useful insights in the development of any financial system, advanced or emerging. After all, the threats can always affect any financial system with more or less similar opportunity of danger. Our policy recommendations and proposals of what is yet to be accomplished aim at achieving the right balance between efficiency and stability in the financial system, which is the goal strived for and honored by central bankers around the world.

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APPENDIX

1A. EXISTING FINANCIAL LINKAGES MODELS

Model Characteristics	Network Simulation Model	Default Intensity Model	Co-risk Analysis	Time-Varying Multivariate Density, Distress Dependence, and Tail Risk
Authors	Chan-Lau, et al. (2009a)	Giesecke and Kim (2009)	Chan-Lau, et al. (2009b)	Chan-Lau, et al. (2009b), Segoviano and Goodhart (2009)
Executed/Calibrated using	Bank for International Settlements cross-border interbank exposures data	Default data from Moody's Default Risk Service	Five-year individual CDS spreads of financial institutions	Individual CDS-probability of defaults and/or stock prices
Outputs	(1) Provides metric on domino effect induced by alternative distress events (2) Identifies systemic linkages and vulnerable countries/institutions (3) Quantifies potential capital losses at country/ institutional level (4) Can track potential contagion paths	(1) Provides metric of potential banking failures due to direct and indirect systemic linkages (2) Provides probability measure of tail events	(1) Estimates of unconditional and conditional credit risk measures for different quantiles (or "risk regimes") (2) Estimates of the effect on conditional credit risk induced by "source" institutions on "locus" institutions during stress regimes	(1) Recovers multivariate density and thus common distress in the system (2) Distress dependence matrix (3) Probability of cascade effects triggered by a particular financial institution
Advantages	(1) Allows identification of most systemic and vulnerable institutions within a system (2) Can be used to elaborate "risk maps" of contagion effects	(1) Captures effects of direct and indirect linkages among financial institutions, as well as the regime-dependent behavior of their default rates (2) Very good predictive power	(1) Captures institutions' codependence risk from direct and indirect linkages (2) Can be used to elaborate "risk maps"	(1) Able to use other probability of defaults (2) Multiple outputs (3) Includes linear and nonlinear dependence (4) Endogenous time-varying distress dependence
Shortcomings	(1) Requires data on inter-institution exposures (2) Static modeling of institutional behavior	Reduced form model	Usefulness is undermined by factors that affect market efficiency	CDS may overstate objective default probabilities

Source: IMF's Global Financial Stability Report (April 2009)

2A. DETAILS ON THE ESTIMATION OF FINANCIAL LINKAGES AND SYSTEMIC RISK

This part provides the details on the data, econometric methodology employed by Roengpitya and Rungcharoenkitkul (2009) whose research follows that of Adrian and Brunnermeier (2008). As mentioned previously in the paper, the approach by Adrian and Brunnermeier (2008) makes it possible to estimate the systemic risk and financial linkages using the publicly-available data which integrates all the possible types of risk together. Unlike the CDS data which captures the effect of credit risk alone, using the financial institution's asset data may have expanded the scope to cover all types of risks taken by an institution.

1. RELATED DEFINITIONS

The value-at-risk (VaR) of an institution at the q quantile (or with q% confidence interval) is defined as the level of an institution-based random variable at which the cumulative probability

distribution of this random variable is equal to q%. Mathematically, the VaR of an institution i at q quantile is

$$\Pr(z^i \leq VaR_q^i) = q$$

where z^i is the institution-based random variable. Please note that usually VaR is a negative number and the authors used $q=99$% throughout the paper. Next, the CoVaR(j|i) is defined as the level of the institution-based random variable of Institution i at which the cumulative conditional probability distribution of this random variable is equal to q%. The conditioning is on Institution X being at its distress VaR level. In other words, it can be defined as

$$\Pr(z^j \leq CoVaR(j \mid i) \mid z^i = VaR_q^i) = q$$

where z^j is Institution j's random variable. Finally, the measurement of Institution i's contribution to Institution j's VaR is measured by

$$\Delta CoVaR(j \mid i) = CoVaR(j \mid i) - VaR_q^j$$

To measure financial linkages, one can think of i and j representing two financial institutions. When assessing the systemic effect, j represents the banking market or the financial market while i will be a financial institution.

The random variable z in this study is the VaR variable which will be the fitted value of growth rates of market valued total financial assets by macroeconomic variables, which is calculated as the normalized change in market value of total financial assets, X_t^i.

$$X_t^i = \left(ME_t^i \cdot LEV_t^i - ME_{t-1}^i \cdot LEV_{t-1}^i\right) \frac{\sum_i ME_{27032009}^i \cdot LEV_{27032009}^i}{\sum_i ME_{t-1}^i \cdot LEV_{t-1}^i} = \left(A_t^i - A_{t-1}^i\right) \frac{A_{27032009}^{system}}{A_{t-1}^{system}},$$

where $ME_t^i \cdot LEV_t^i$ is the market value of the total financial assets of Institution i, where ME_t^i is the market value of Institution i's total equity at time t and LEV_t^i is the ratio of total assets to book equity. The last date on the data entry, March 27th, 2009, was chosen as the base time period. To obtain the system-wide proxy, the authors calculated it as the weighted sum of X_t^i across all institutions,

$$X_t^{system} = \sum_i X_t^i = \left(A_t^{system} - A_{t-1}^{system}\right)\frac{A_{27032009}^{system}}{A_{t-1}^{system}},$$

where again the reference date is March 27th, 2009.

2. ESTIMATES FOR SYSTEMIC RISK: CONCEPT AND METHODOLOGY

Roengpitya and Rungcharoenkitkul (2009) estimated the VaR by means of quantile regressions at 99-percent level for each institution, using the weekly stock market data.[52] For an institution i, we regress

$$X_t^i = \alpha^i + \beta^i M_t + \varepsilon_t^i,$$

where M_t is the group of independent variables that predict well the normalized change in total asset value in the Thai stock market, namely the SET weekly return variable (four lags included in total, t-1, t-2, t-3 and t-4) and the SET 30-day volatility variable (four lags also). Then, the value-at-risk of an institution i at time t with confidence q=99% is just a fitted value of the quantile regression:

$$VaR_t^i = \alpha^i + \beta^i M_t.$$

To measure the CoVaR(j|i), the quantile regression is of the form:

$$X_t^j = \widetilde{\alpha}^j + \widetilde{\beta}^j M_t + \widetilde{\gamma}^j X_t^i + \widetilde{\varepsilon}_t^{j,i},$$

and the CoVaR(j|i) is

$$CoVaR(j\,|\,i) = \widetilde{\alpha}^j + \widetilde{\beta}^j M_t + \widetilde{\gamma}^j VaR_t^i,$$

where VaR_t^i is usually the distress level of Institution i's VaR (at 99% generally). Similarly, we can calculate the system VaR using the similar concept:

$$X_t^{system} = \alpha^{system} + \beta^{system} M_t + \varepsilon_t^{system} \implies VaR_t^{system} = \alpha^{system} + \beta^{system} M_t.$$

$$X_t^{system} = \widetilde{\alpha}^{system} + \widetilde{\beta}^{system} M_t + \widetilde{\gamma}^{system} X_t^i + \widetilde{\varepsilon}_t^{system,i} \implies CoVaR(system\,|\,i) = \widetilde{\alpha}^{system} + \widetilde{\beta}^{system} M_t + \widetilde{\gamma}^{system} VaR_t^i$$

and finally ΔCoVaR is calculated as

$$\Delta CoVaR(j\,|\,i) = CoVaR(j\,|\,i) - VaR^j$$

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[52] Adrian and Brunnermeier (2008) sorted out the bank characteristics into "portfolios." However, since there are only a limited number of financial institutions in the Thai sample, the quantile regression was done by institution instead.

and *j* can be either an institution or the system.

As for the data of the banking industry systemic risk estimation in Topic II Section 3.2 and the financial linkage estimation in Section 3.4, the authors used the weekly stock market data from Bloomberg covering the period between the weeks of March 29th, 1996 to March 27th, 2009. For the data of the financial system including banks, finance and securities companies and insurance companies, the period used in the estimation is between April 21, 2000 and March 27th, 2009.

3A. DETAILS ON THE ESTIMATION OF THE LEVEL OF PROCYCLICALITY IN THAILAND

Our next objective is to assess the degree of procycality in Thailand. Later this part, we attempt to identify the bank specific variables contributing procyclicality in the financial system. Two variables emphasized are provision and price of risk. For this purpose, we employ unbalanced panel regression (fixed-effects model) of bank specific data and macroeconomic data, based on Craig, Davis, and Pascual (2006) and our theoretical analysis.

$$rcreditg_{i,t} = \beta_0 + \beta_1 rgdpg + \beta_2 infl + \beta_3 rint + \sum_{i=4}^{n} \beta_i control_{i,t-4} + \sum_{j=1}^{72} bdum_j + \varepsilon_{i,t}$$

- **rcreditg** = $(credit_t/cpi_t) / (credit_{t-4}/cpi_{t-4})$, denotes annual growth of real credit, **credit** denotes credit to private sector, **cpi** is the consumer price index, and **t** denotes, quarters.
- **rgdpg** = $(gdp_t) / (gdp_{t-4})$, denotes annual growth of real GDP, **gdp** denotes real GDP.
- **rint** = $\ln[(1+int_t) / (1+cpi_{t-4})]$, denotes annual growth of real interest rate, **int** denotes overnight interbank rate.
- **control** denotes control variables that prior studies have found to affect loan growth. Bank specific variables are lagged four quarters to avoid simultaneity problem. The control variables include **loan-to-asset** as a proxy for credit risk, **loan-to-deposit** as a proxy for liquidity risk, **pricing margin** (interest receipts /assets less the money market rate) as a proxy for the pricing of credit risk, and **BIS ratio** as a proxy for bank's ability to absorb losses.
- **bdum** denotes bank dummy for capturing idiosyncratic bank effects.

- **rhpig** = (housing prices$_t$/cpi$_t$) / (housing prices$_{t-4}$/cpi$_{t-4}$), denotes annual growth of real housing prices, **housing prices** denotes house price index[53].

As credit growth is driven by capacity of bank to lend as well as external demands, this estimation uses the bank specific data to reflect banks' capacity and macroeconomic data to reflect demand for credit. We use the quarterly data from all Thai commercial banks over the period 1993Q1 – 2009Q1. As discussed in section 4.1, the whole sample is divided into two sub periods, until the Asian crisis (1993Q1 – 1998Q4) and after the crisis (2003Q1 – 2009Q1). Since some of the banks merged, closed, and begin during that period, we have unbalanced panel data. All data were obtained from Bank of Thailand database except house price index obtained from Real Estate Information Center (REIC). Summary statistics for the available data covering the period of 1993Q1-1998Q4 is shown in the following table.

Variables	Observation	Mean	Std. Dev.	Min.	Max
annual growth of real credit (%)	370	36.36	276.17	-88.52	3,175.71
Macroeconimic					
annual growth of real GDP (%)	370	-2.52	15.32	-45.58	12.33
real interest rate (%)	319	4.79	3.66	-0.89	11.87
inflation	370	5.52	1.66	3.02	9.80
Bank specific					
loan-to-asset	370	80.01	8.87	32.78	123.30
loan-to-deposit	351	138.81	487.30	49.16	9,225.66
pricing margin (%)	165	-4.48	3.93	-15.43	1.19
BIS ratio	338	9.59	2.96	0.83	35.44

And the summary statistics for the period 2003Q1-2009Q1 is as follows.

Variables	Observation	Mean	Std. Dev.	Min.	Max
annual growth of real credit (%)	324	9.34	44.62	-96.62	312.05
Macroeconimic					
annual growth of real GDP (%)	324	3.46	4.17	-12.12	8.01
real interest rate (%)	324	-0.49	1.86	-3.88	2.17
inflation	324	3.64	1.95	-0.23	7.23
Bank specific					
loan-to-asset	324	70.65	12.39	33.20	100.12
loan-to-deposit	324	109.49	109.32	45.77	1,719.23
pricing margin (%)	324	-1.54	1.34	-3.61	2.25
BIS ratio	313	16.28	8.15	5.10	55.23

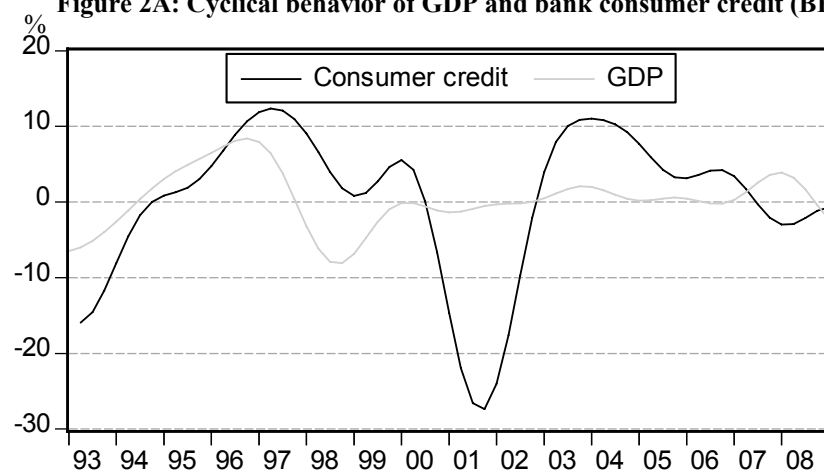
[53] Source: Real Estate Information Center (Thailand)

The following figures exhibit the behaviors of corporate credit and consumer credit and real GDP while the last figure reflects the behavior of consumer credit and housing price.

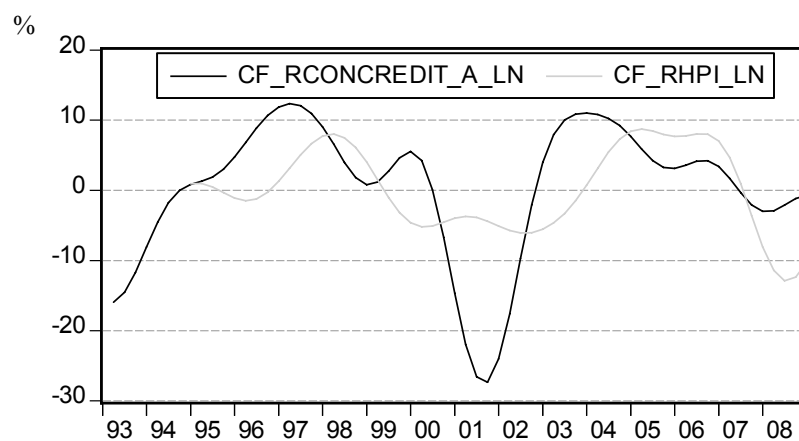**Figure 1A: Cyclical behavior of GDP and bank corporate credit (BP)**
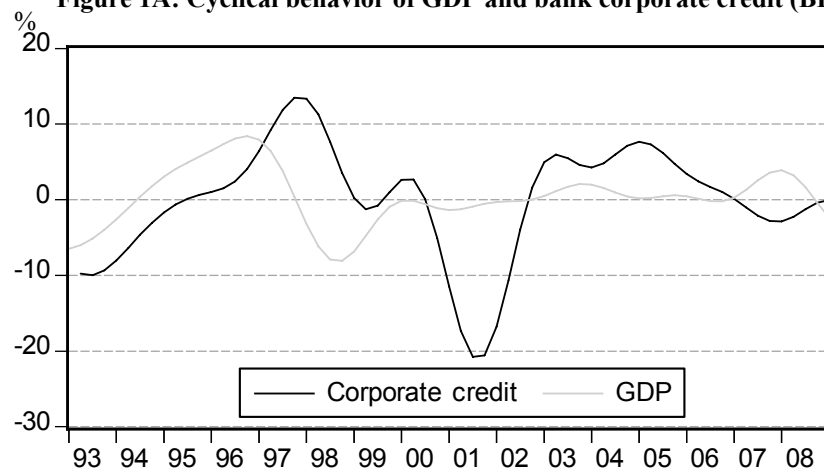
Source: Bank of Thailand, authors' calculation

Figure 2A: Cyclical behavior of GDP and bank consumer credit (BP)

Source: Bank of Thailand, authors's calculation

Figure 3A: Cyclical behavior of house price index, and bank consumer credit (BP)

Source: Bank of Thailand, Real Estate Information Center, and authors' calculation