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บทบาทของระบบสถาบันการเงินต่อเศรษฐกิจไทย: บทเรียนจากการหดตัวของสินเชื่อในช่วงวิกฤตเศรษฐกิจ

Banking Sector Fundamentals: Learning from the Recent Bank Lending Contraction

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บทสรุป

ข้อคิดเห็นที่ปรากฏในบทความนี้เป็นความเห็นส่วนตัวของผู้เขียนโดยเฉพาะ ซึ่งไม่จำเป็นต้องสอดคล้องกับนโยบายของธนาคารแห่งประเทศไทย

บทความนี้ศึกษาถึงสาเหตุของการหดตัวของสินเชื่อในระบบธนาคารพาณิชย์ในช่วงที่ผ่านมา เพื่อให้ได้ข้อสรุปเชิงนโยบายต่อการเจริญเติบโตทางเศรษฐกิจในอนาคต โดยศึกษาจากข้อมูลทั้งในระดับมหภาคและในระดับจุลภาค สำหรับการศึกษาระดับมหภาคซึ่งใช้ข้อมูลรวมของระบบ จะใช้แบบจำลองทางเศรษฐมิติหาความสัมพันธ์เชิงปริมาณของปัจจัยด้านอุปสงค์เปรียบเทียบกับปัจจัยด้านอุปทานที่ทำให้สินเชื่อหดตัวในช่วงวิกฤตเศรษฐกิจที่ผ่านมา สำหรับการศึกษาในระดับจุลภาคจะพิจารณาจากข้อมูลงบการเงินรายธนาคาร เพื่อวิเคราะห์ความสัมพันธ์ระหว่างพฤติกรรมการปล่อยสินเชื่อและฐานะการดำเนินงานรวมทั้งความมั่นคงของธนาคาร ผลจากการศึกษาพบว่าปัญหาด้านความสามารถในการปล่อยสินเชื่อของธนาคารและปัญหา NPLs ของธนาคารพาณิชย์ซึ่งเคยเป็นปัจจัยสำคัญต่อการหดตัวของสินเชื่อในอดีต น่าจะหมดไปแล้วในปัจจุบัน

บทสรุปผู้บริหาร
บทบาทของระบบสถาบันการเงินต่อเศรษฐกิจไทย: บทเรียนจากการหดตัวของสินเชื่อในช่วงวิกฤตเศรษฐกิจ

สินเชื่อจากระบบธนาคารพาณิชย์มีบทบาทต่อการขยายตัวของเศรษฐกิจไทยค่อนข้างมากตั้งแต่ในอดีตที่ผ่านมา แม้ว่าในระยะหลังธุรกิจเอกชนจะได้มีการพึ่งพิงแหล่งเงินทุนจากตลาดหุ้นและตราสารหนี้มากขึ้น บทความนี้จึงมีวัตถุประสงค์ที่จะนำเสนอข้อมูลและข้อเท็จจริงเกี่ยวกับการเปลี่ยนแปลงของปริมาณสินเชื่อภาคเอกชนของธนาคารพาณิชย์ช่วงหลังเกิดวิกฤตเศรษฐกิจ โดยพยายามตอบปัญหาหลักสองข้อ ได้แก่

1. ในช่วงที่ปริมาณสินเชื่อภาคเอกชนของธนาคารพาณิชย์มีการหดตัวอย่างรุนแรงในปี 2541 นั้น มีสาเหตุใหญ่มาจากการหดตัวของอุปสงค์หรืออุปทาน อย่างไร

2. การที่สินเชื่อภาคเอกชนของธนาคารพาณิชย์ในปัจจุบันยังขยายตัวในเกณฑ์ที่ต่ำ ทั้งที่เศรษฐกิจเริ่มแสดงการฟื้นตัวอย่างชัดเจนนั้น เป็นไปได้หรือไม่ที่ธนาคารพาณิชย์ไทยมีปัญหาในด้านอุปทาน

เพื่อตอบปัญหาดังกล่าว บทความนี้ได้แบ่งการศึกษาออกเป็น 2 ระดับ คือ ระดับมหภาค ซึ่งใช้ข้อมูลสินเชื่อรวมของระบบธนาคารพาณิชย์ และระดับจุลภาค ซึ่งใช้ข้อมูลจำเพาะของธนาคารพาณิชย์แต่ละแห่ง

ในส่วนของการศึกษาระดับมหภาค ได้ใช้วิธีวิเคราะห์หาความสัมพันธ์ทางเศรษฐมิติ โดยแบ่งปัจจัยที่กำหนดอุปทานของสินเชื่อภาคเอกชนของธนาคารพาณิชย์เป็น 2 ปัจจัย คือ 1. ความสามารถในการปล่อยสินเชื่อของธนาคาร ซึ่งวัดจากปริมาณเงินทุนและเงินกองทุนที่ต้องดำรงของธนาคารพาณิชย์ และ 2. ความยินดีหรือความเต็มใจในการปล่อยสินเชื่อของธนาคาร ซึ่งวัดจากภาวะเศรษฐกิจและความเสี่ยงในการปล่อยสินเชื่อที่ธนาคารสามารถรับได้

ทั้งนี้ ผลของการศึกษาในระดับมหภาค พบว่าทั้งอุปสงค์และอุปทานมีส่วนร่วมในการกำหนดความเคลื่อนไหวของปริมาณสินเชื่อภาคเอกชน โดยในช่วงหลังการเกิดวิกฤตเศรษฐกิจในปี 2541 ทั้งอุปสงค์และอุปทานของสินเชื่อภาคเอกชนมีการหดตัวอย่างรุนแรง ส่งผลให้ปริมาณสินเชื่อรวมลดลงอย่างรวดเร็ว อย่างไรก็ตาม ดูเหมือนว่าการหดตัวของอุปทานเกิดขึ้นก่อนหน้าการหดตัวของอุปสงค์ จึงอาจกล่าวได้ว่า ปัญหาของระบบธนาคารพาณิชย์มีความสำคัญอย่างมากต่อการทรุดตัวของเศรษฐกิจไทยในช่วงนั้น อย่างไรก็ดี ในช่วงต่อ ๆ มาจนถึงปัจจุบัน พบว่า ทั้งอุปสงค์และอุปทานของสินเชื่อภาคเอกชนเคลื่อนไหวไปในทิศทางเดียวกัน

และมีปริมาณไม่แตกต่างกันมากนัก โดยในส่วนของปัจจัยด้านอุปทานนั้น ไม่พบว่าทางธนาคารมีปัญหาในความสามารถในการปล่อยสินเชื่อ จึงอาจกล่าวได้ว่า นโยบายของรัฐบาลในการช่วยแก้ไขปัญหาเรื่องทุนของธนาคารพาณิชย์ค่อนข้างได้ผล แต่ที่อุปทานไม่เพิ่มขึ้นนั้นน่าจะเป็นเพราะธนาคารพาณิชย์ยังไม่แน่ใจในภาวะเศรษฐกิจ ดังนั้น ในปัจจุบันการที่สินเชื่อยังขยายตัวในเกณฑ์ต่ำมิได้เป็นผลมาจากความสามารถในการปล่อยสินเชื่อของธนาคารพาณิชย์ แต่เป็นเพราะภาวะเศรษฐกิจที่ตกต่ำ ซึ่งกระทบทั้งความยินดีในการปล่อยสินเชื่อของธนาคารและความต้องการสินเชื่อของภาคเอกชน

อย่างไรก็ตาม แม้ว่าการศึกษาระดับมหภาคโดยใช้ความสัมพันธ์ทางเศรษฐมิติจะสามารถแสดงภาพรวมของสภาวะสินเชื่อภาคเอกชนของธนาคารพาณิชย์ได้ระดับหนึ่ง ก็ยังมีข้อจำกัดในด้านข้อมูลที่ไม่สอดคล้องกันในช่วงก่อนและหลังวิกฤตเศรษฐกิจ เช่น ข้อมูลการจัดชั้นสินทรัพย์ การกันสำรอง และสินเชื่อที่ไม่ก่อให้เกิดรายได้ (NPLs) ทำให้ไม่สามารถทราบปัจจัยทางด้านอุปทานได้อย่างชัดเจน ทำให้จำเป็นต้องมีการวิเคราะห์ระดับจุลภาค โดยใช้ข้อมูลฐานะของสถาบันการเงินในช่วงหลังวิกฤตซึ่งอยู่ภายใต้เกณฑ์การจัดชั้นเดียวกัน

การศึกษาในระดับจุลภาคนี้ เน้นศึกษาตัวแปรด้านอุปทานที่สะท้อนถึงฐานะของสถาบันการเงิน ได้แก่ สัดส่วนสินเชื่อที่ไม่ก่อให้เกิดรายได้ต่อสินเชื่อทั้งสิ้น สัดส่วนสำรองสินทรัพย์จัดชั้นที่ธนาคารมีอยู่ต่อสำรองที่พึงกันตามเกณฑ์ของทางการ และสัดส่วนเงินกองทุนต่อสินทรัพย์เสี่ยง ว่ามีส่วนอธิบายการหดตัวของสินเชื่อจากระบบธนาคารพาณิชย์ไทยในช่วงหลังวิกฤตเศรษฐกิจหรือไม่ และมีส่วนอธิบายการปรับองค์ประกอบของสินเชื่อจากสินเชื่อที่ให้แก่ภาคธุรกิจซึ่งมีน้ำหนักความเสี่ยงตามเกณฑ์ของ BIS ที่สูง เป็นสินเชื่อที่มีน้ำหนักความเสี่ยงต่ำ ได้แก่ สินเชื่อเพื่อที่อยู่อาศัยที่ให้แก่ภาคครัวเรือน สินเชื่อที่ให้แก่สถาบันการเงิน และสินเชื่อสำหรับโครงการสาธารณูปโภคของภาครัฐหรือไม่ โดยใช้วิธีการจัดกลุ่มธนาคารพาณิชย์ที่มีลักษณะอุปสงค์คล้ายคลึงกันให้อยู่ในกลุ่มเดียวกัน แล้วพิจารณาว่าธนาคารเหล่านี้มีปัจจัยทางด้านอุปทานต่างกันหรือไม่ หากมีความแตกต่างกันจะสรุปได้ว่าพฤติกรรมการปล่อยสินเชื่อที่ต่างกันน่าจะมีสาเหตุจากปัจจัยด้านอุปทานดังกล่าวด้วย

ผลการศึกษาพบว่า ธนาคารที่มีสัดส่วน NPLs สูง ในช่วงปี 2541 มีการหดตัวของสินเชื่อในปี 2542 ในอัตราที่สูงกว่าเมื่อเทียบกับธนาคารที่มีสัดส่วน NPLs ที่ต่ำกว่า อย่างไรก็ตาม ความสัมพันธ์ในเชิงลบระหว่างสัดส่วน NPLs และอัตราการเปลี่ยนแปลงของสินเชื่อดังกล่าวได้หมดไปในระยะเวลาต่อมา สำหรับตัวแปรด้านอุปทานอื่นไม่ได้มีส่วนอธิบายการหดตัวของสินเชื่ออย่างมีนัยสำคัญ และการปรับองค์ประกอบของสินเชื่อจากประเภทที่มีความเสี่ยงสูงเป็นประเภทที่มีความเสี่ยงต่ำน่าจะมีสาเหตุจากปัจจัยด้านอุปสงค์มากกว่าปัจจัยด้านอุปทาน

ผลการศึกษาทั้งในระดับมหภาคและในระดับจุลภาคชี้ให้เห็นว่าประเทศไทยได้ผ่านช่วงที่ร้ายแรงที่สุดของวิกฤตการหดตัวของสินเชื่อธนาคารพาณิชย์ไปแล้ว โดยปัญหาหลักในด้านอุปทาน ไม่ว่าจะเป็นเรื่องของความสามารถในการปล่อยสินเชื่อหรือ NPLs น่าจะหมดไปแล้ว คงมีแต่เรื่องของภาวะเศรษฐกิจที่ยังไม่ชัดเจนเท่านั้นที่ยังเป็นอุปสรรคต่อการฟื้นตัวของสินเชื่อ ซึ่งหากเศรษฐกิจไทยยังขยายตัวดีต่อเนื่องดังเช่นที่เป็นมาในช่วงครึ่งแรกของปีนี้แล้ว ในไม่ช้าน่าจะได้เห็นการขยายตัวของสินเชื่อภาคเอกชนของธนาคารพาณิชย์ในระดับที่สูงอีกครั้งหนึ่ง

อย่างไรก็ตาม ทั้งทางภาครัฐบาลและธนาคารพาณิชย์ไม่ควรนิ่งนอนใจในปัญหา NPLs เพราะหากเศรษฐกิจไทยไม่ฟื้นตัวอย่างที่หลายฝ่ายคาดไว้ NPLs อาจมีโอกาสกลับมาสร้างปัญหาอีก จึงควรมีการเร่งรัดให้ธนาคารพาณิชย์ยกระดับมาตรฐานระบบการปริหารความเสี่ยงสินเชื่อเพื่อป้องกัน NPLs ที่อาจเกิดขึ้นใหม่ในอนาคต ซึ่งเมื่อใดก็ตาม ที่ธนาคารพาณิชย์มีระบบการบริหารความเสี่ยงสินเชื่อที่ดี โอกาสที่เศรษฐกิจไทยจะขยายตัวได้อย่างยั่งยืนก็จะมีสูงขึ้นตามไปด้วย

1. Introduction

For much of Thailand's modern economic history, the banking sector has been the financing pillar of the country's economic growth. During this period, the Thai economy has undergone a few credit cycles wherein run-ups in bank lending preceded subsequent credit slowdowns. Yet, never before in the past 50 years has there been a dramatic decline in bank credit to the private sector as in the recent credit cycle. The free fall in bank credit that began in 1998 was followed by a period of sluggish loan growth. The timing of this unprecedented credit contraction coincided with Thailand's most severe economic crisis since the second World War. Now with signs of a new cycle commencing again, it is essential for policymakers to learn from this past event so as to ensure sustainable economic growth.

When bank credit growth slows or contracts, a natural policy question to ask is whether the movement in credit is supply or demand led. The answer to this question helps policymakers find and prioritize appropriate policy measure to bring the economy back to its proper course. If demand factors are the whole story, then the traditional fiscal and monetary policies to stimulate domestic demand should be enough. However, if some supply constraints (whether from the banks' inability or from the banks' unwillingness to lend) are involved, then structural measures aiming at removing supply impediments are warranted.

Whether supply or demand factors are relatively more important in the recent credit downswing continues to generate controversies among observers. Several believe that supply factors are the main driving force behind the sharp credit contraction as well as the current sluggish credit growth. On the other hand, others have argued that movements in credit are simply responses to weak demand for credit.

The objective of this paper is to investigate systematically the relative importance of credit supply and demand factors in the recent credit contraction. Specifically, the paper attempts to address two key questions. First, was there a "credit crunch" where increased rationing by banks prevented creditworthy borrowers from obtaining needed credit[1] during early 1998? Second and probably more importantly, are there any supply constraints that keep the current credit expansion at an extremely slow pace?

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[1] Section 3 gives a formal definition of credit crunch used in this paper.

To answer these two questions, this paper carefully analyses both the macro- and microeconomic evidence surrounding the recent credit contraction. At the macroeconomic (aggregate) level, this is accomplished by adopting an explicit disequilibrium estimation framework used in recent studies of credit slowdown in East Asia and Latin America by the World Bank and the IMF. The disequilibrium framework allows us to see whether credit supply or credit demand is the binding constraint at any point in time. While there are certain limitations to this approach, we believe it is appropriate for our study, as credit crunch is by definition a disequilibrium phenomenon.

Because data unavailability precludes us from using non-performing loans (NPLs) and loan loss provisions data, two key credit supply factors, in our macro level analysis, there is a potential danger of basing the conclusion solely on macro findings. To fill in the gap left out by the aggregate analysis, the paper also examines data pertaining to selected individual banks. In particular, the paper investigates the relationship between the two missing supply factors and banks' lending behavior. The rationale behind this undertaking is that significant negative relationship between the two (conditioned for demand and institutional factors) would indicate a nontrivial contribution of supply factors to credit movements.

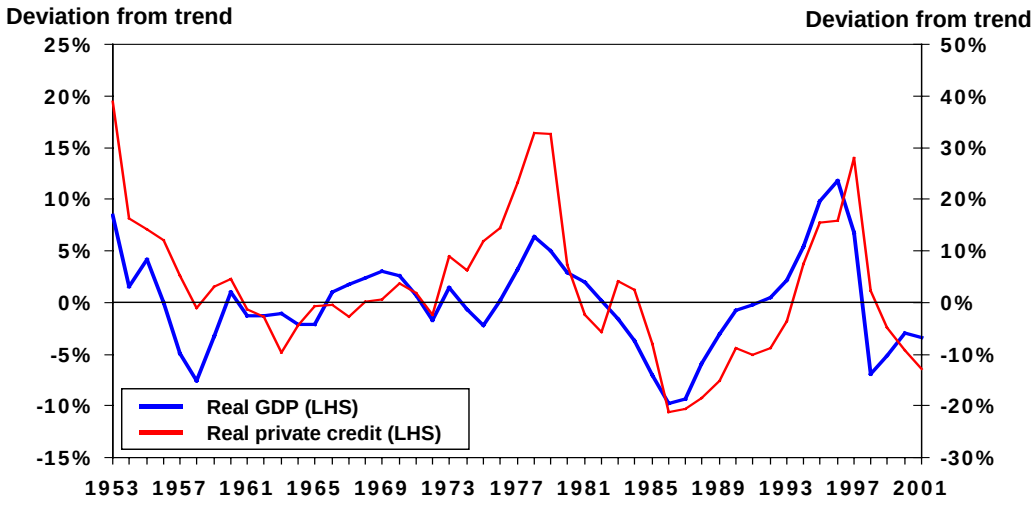
Taken together, the results of our macro and micro level analyses suggest that both supply and demand factors play a significant role in determining post-crisis credit movements. Initial contraction in credit supply was soon accompanied by subsequent collapse in credit demand, resulting in a sharp decline in bank lending in 1998. Both the estimated demand and credit supply also appeared to move more or less in the same direction during the subsequent period. In addition, the paper finds that availability of loanable funds and NPL overhang, both of which appeared to play a prominent role during the early stage of the contraction period, are no longer major constraining factors of bank credit supply.

The rest of the paper is organized as follow. Section 2 takes a brief look at the importance of bank lending in Thailand and the recent credit contraction from a historical perspective. Sections 3 and 4 present, respectively, the macro and micro level analyses. Section 5 concludes.

2. Evolution of Bank Lending in Thailand: An Overview

The relationship between bank credit and economic activity in Thailand is a long-standing one. This relationship can be easily demonstrated by a simple regression or a plot of credit and GDP growth overtime. Here, we present an alternative illustration based on a similar analysis by Walsh and Wilcox (1995). Before we proceed, however, it should be noted that, unless mentioned otherwise, the private credit series that we use in this paper is the adjusted series in which loan write-offs and net loan transfer to asset management companies are added back to the original series[2]. Such adjustment is increasingly common in the literature as the adjusted series better represents the true stock of bank credit to the private sector.

Figure 1. Cyclical components of real private credit and real GDP, 1953-2001



Sources: Bank of Thailand; IFS; authors' calculation

Figure 1 plots the cyclical components of annual real private credit and real GDP from 1953 to 2001. These series are computed by removing a Hodrick-Prescott (HP) trend from each of the respective underlying series. Figure 1 clearly shows that (detrended) real private credit and real GDP track each other quite closely with private credit being more volatile. Over the entire sample period, it is not possible to say which series lags or leads the other. But for the past 20 years or so, real GDP appeared to precede real private credit.

[2] Even the unadjusted series deserves an explanation. What we call private credit in this paper is essentially the sum of commercial banks' claims on business and household sector and claims on other financial institutions.

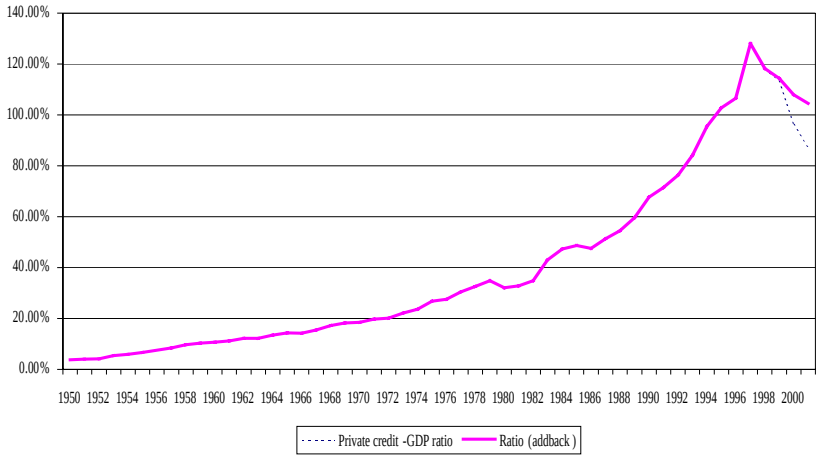
2.1. Importance of Bank Finance

For better or worse, the Thai economy would not be where it is today without the economy's heavy reliance on bank credit. Arguably, the development of the Thai economy was fostered and sustained by strong credit growth. Yet, being too dependent has a drawback. The economic crisis would probably be less severe if Thai's firms were not too dependent on banks.

In this subsection, we look at the two key indicators to gauge the importance of bank finance in the Thai economy: (1) the ratio of private credit to GDP and (2) banks' share of financial markets. The first indicator measures the size of the banking sector relative to the aggregate economy while the second indicator measures the size of the banking sector relative to those of other financing sources of the economy.

The ratio of private credit to GDP. There are several ways to measure the size of the banking sector relative to the economy (*e.g.*, the banking sector's total asset-to-GDP and total loans-to-GDP ratios), but the ratio of (claims on) private credit to GDP is probably the most widely used indicator in the academic and policy literature. Figure 2 tracks the evolution of this ratio for Thailand from 1950 to 2001. Starting from around 5%, the ratio of private credit to GDP increased nearly steadily, reaching a peak of 130% in 1997 before dropping to 105% at the end of 2001 (87 % in the case of the unadjusted (no add-back) series).

Figure 2. Private credit to GDP ratio, 1950-2001

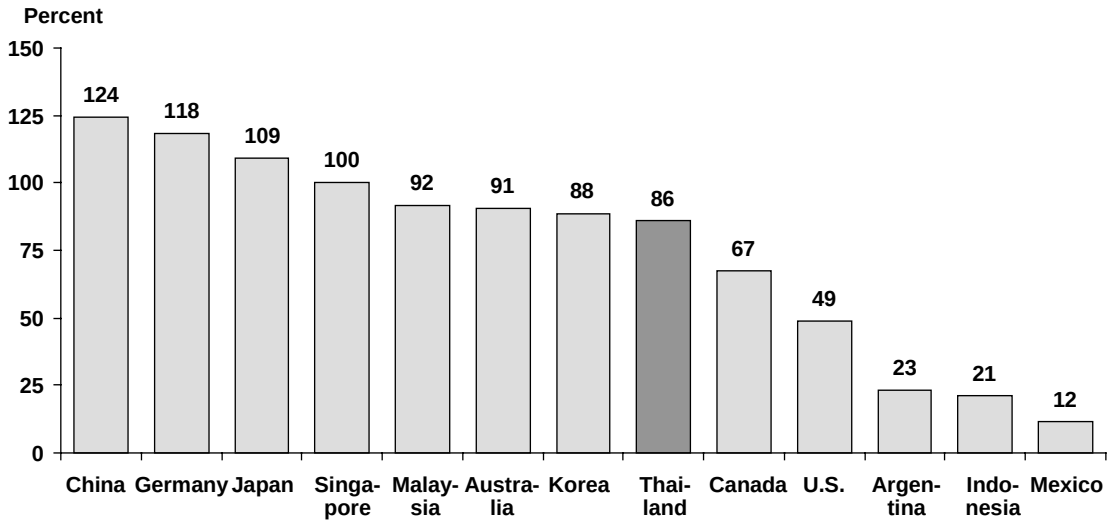


Source: Bank of Thailand; IFS

We do not want to overstress the significance of the 130% figure, as part of the increase in private credit in 1997 has to do with the devaluation of the baht. What we want to bring to attention is that the private credit-to-GDP ratio for Thailand already exceeded the 100% level in 1995. Behind this dramatic increase was the fact that the banking sector had been growing much faster than the entire economy during much of the pre-crisis period.

Using IFS data (Deposit Money Banks Table in the case of private credit), Figure 3 compares Thailand's 2000 (unadjusted) private credit-to GDP ratio with those of eleven other countries. It should be noted that the use of the unadjusted private credit data understates the true size of the banking sectors in some of these countries. But we have no choice because the adjusted data are not available cross-country-wise.

Figure 3. 2000 ratios of private credit* to GDP, selected countries



Note: Unadjusted figures; excludes claims on other financial institutions (OFIs)
Source: IFS

From Figure 3, one can immediately see that the size of the Thai banking sector relative to the aggregate economy sector is comparable to most of countries shown here

(especially when compared to Asian countries[3]). Nonetheless, its sheer size implies that unless the banking sector becomes healthy again (a good indicator of that happening would be the resume of a strong credit growth), the current economic recovery will unlikely be sustained.

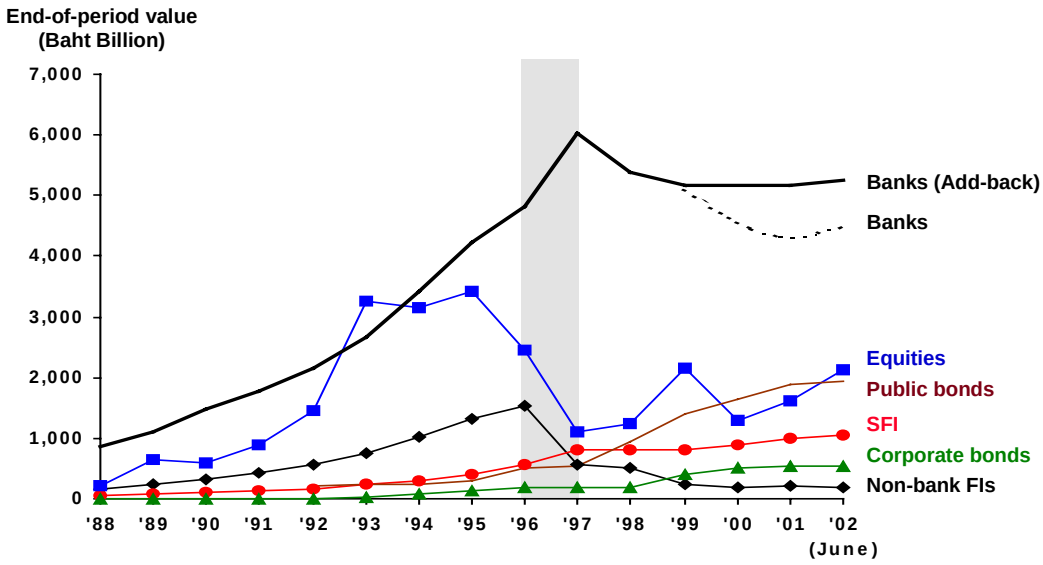
Banks' share of financial markets. For much of Thailand's modern economic history, banks have been the dominant financing source of the economy. In order to see this, we break down Thai financial markets into five constituents: banks, non-bank financial institutions (finance companies, finance and securities companies, credit foncier companies, and life insurance companies), specialized financial institutions (SFIs, comprising Government Savings Bank, Government Housing Bank, Bank for Agriculture and Agricultural Cooperatives, Export-Import Bank of Thailand, Industrial Finance Corporation of Thailand, and Small Industries Finance Corporation), the stock market, and the bond market.

Figure 4 shows end-of-period values of these five constituents, with the bond market further broken down into public and corporate segments, from 1988 to June 2002. The sizes of financial institutions are proxied by credits extended by respective types of institution (For commercial banks: bills, loans, and overdrafts excluding inter-bank transaction[4]). The sizes of the stock and the bond markets are proxied respectively by equity market capitalization and par value of bonds outstanding, a common practice in the literature. Figure 5 shows the shares of all the constituents in percentage terms.

[3] The low number for Indonesia, the sole exception here, reflects the massive restructuring effort by the Indonesian government. Still, Indonesia's private credit-to-GDP ratio was only about 60% at its peak in 1997, indicating a low degree of financial deepening by an Asian standard.

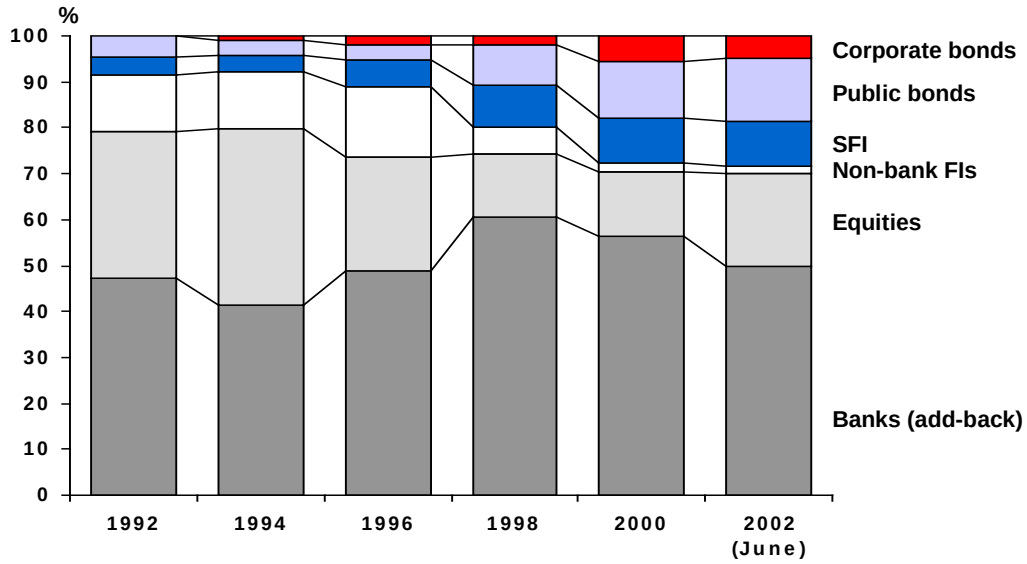
[4] We use bills, loans, and overdrafts rather than private credit, which include investments in securities, to prevent double counting.

Figure 4. Outstanding values of credit extended by financial institutions, stocks, and bonds, 1988-2002



Sources: Bank of Thailand; SET; TBDC

Figure 5. Percent break down of Thai financial markets, 1992-2002



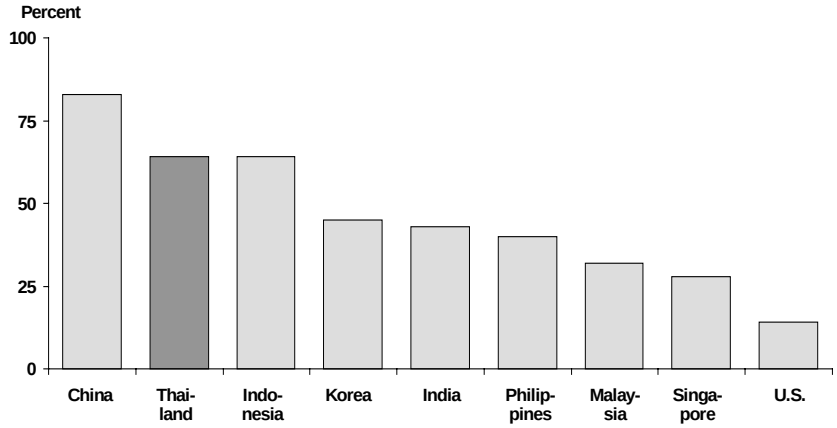
Sources: Bank of Thailand; SET; TBDC

A look at Figures 4 and 5 reveals several interesting observations. First, the banks are by far the most dominant constituents of Thai financial markets. Despite a sizable decline in the absolute volume of bank credit, as of June 2002, banks still account for about a half of Thai financial markets. Second, the crisis has almost completely wiped out non-bank

financial institutions (mostly due to the closure of many finance and finance and securities companies) from the Thai financial market landscape. Third, as the role of non-bank financial institutions diminishes, the role of SFIs has increased significantly. Fourth, since 1998, there has been a marked increase in volume of public bonds, led by the Bt500bn Ministry of Finance's recapitalization bonds for the Financial Institutions Development Fund (FIDF). The growing size of the public bond market is expected to substantially change the Thai financial market landscape. In fact, once the sale of the new Bt300bn government bonds is completed later this year, the public bond market will surpass the stock market as the second largest constituent of Thai financial markets. Fifth, the stock market, which at one time displaced banks as the most dominant financial market constituent, is making a slow comeback. Finally, apart from the public bond segment, Thailand's young corporate bond market (est. 1992) is probably the fastest growing of all constituents. This rapid development of the Thai corporate bond market can be attributed to two major factors. First, low interest rates on bank deposit have prompted many investors to look for alternative investments. Second, there seems to be a structural change in the financing pattern of Thai blue chips companies. The increased role of direct financing by corporations is even more evident when one looks at flow data (not shown). As intermediated funds continues to contract, new stocks and corporate bonds issued have been increasing rapidly in the past couple years

Just how significant is the relative importance of banks? Figure 6, taken from a recent paper by Shirai (2001), compares bank loans as a percentage of the private sector's external finance (defined by the author as the sum of bank loans, stock market capitalization, and outstanding value of corporate bonds) for nine countries during the past decade.

Figure 6. Banks' share of private sector's external finance



Note: 1990-9 averages except for China (1996-9), India (1995-8), Indonesia (1995-9), the Philippines (1996-9), Singapore (1990-8), and the United States (1990-8). The original figure for Thailand was for 1995-9. Here, we recalculate the Thai figure using data for the entire period.

Source: Shirai (2001)

A look at figure 6 reveals that Thailand is much more bank-dependent than most of the countries shown there[5]. Bank loan's share of external finance for Thailand is second only to China. With bank loans making up such a high percentage of external finance, there is no surprise that a sharp decline in bank lending have had a significant impact on the Thai economy. Additionally, the private sector's heavily reliance on bank loans implies a rebound in bank lending as a pre-condition to overall economic recovery[6].

2.2. The 1998-2001 Credit Contraction from a Historical Perspective

The evolution of bank credit in Thailand post crisis is unlike any other periods in the past 50 years. Before 1998, yearend banks' private credit never grew at a rate of less than 5% annually, let alone contracted. Despite much talk about the current credit recovery, the current growth rate of private credit pales in comparison to its pre-crisis average (Table 2).

[5] Note that Shirai's (2001) finding goes against a series of paper by the World Bank (*e.g.*, Demirguc-Kunt and Levine, 1999) which assert that Thailand has a market-based financial system. The World Bank's conclusion was based on 1995 data when inflated asset prices made the SET market capitalization roughly the same size as bank loans. (See Figure 5.)

[6] A good and more direct indicator of the private sector's reliance on bank finance is firms' percent of debt owed to banks. Unfortunately, this data is not available in the case of Thailand.

Table 2. Growth in private credit, 1951-2002 (June)

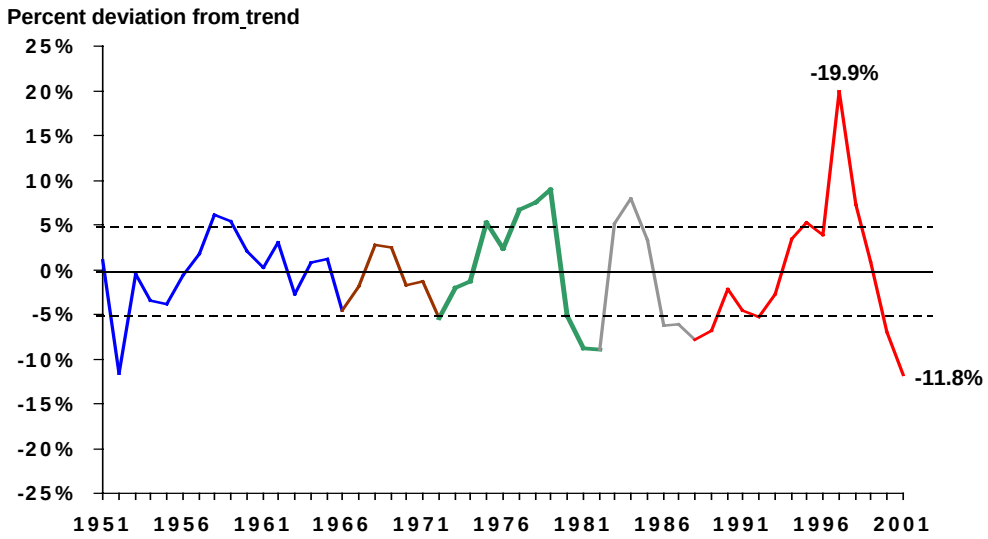
	1951-1997	1998-2000	2001	Jan 2002	Feb 2002	Mar 2002	Apr 2002[1]	May 2002[1]	Jun 2002[1]
Growth rate (%)	21.1	-4.3	-0.1	0.7	1.2	0.8	1.2	2.2	1.4

Note: Excluding Thanachart Bank

Source: Bank of Thailand

To assess the severity of the recent credit contraction in historical context, we perform the following exercise based on a study of credit cycles throughout the world by Gourinchas, *et. al.* (2000). The procedure is similar to what we did with real private credit and real GDP at the beginning of Section 2. We first compute the trend in the private credit-to-GDP ratio using a Hodrick-Prescott filter and then plot overtime percent deviations of the private credit-to-GDP ratio from the resulting HP trend[7]. We then define a credit cycle as a movement from trough to trough of the (detrended) ratio. Figure 7 shows the result of this exercise.

Figure 7. Thai credit cycles, 1951-2001



Sources: Bank of Thailand; IFS; authors' calculation

[7] Our procedure differs slightly from the one used by Gourinchas, et. al. (2000). Instead of using real GDP at time *t* as a denominator for time *t* credit-GDP ratio, they use the average of time *t* and *t*+1 real GDPs. Both procedures yield qualitatively the same conclusion.

As can be seen from Figure 7, Thailand has gone through a few credit cycles in the past 50 years. Before the recent credit contraction, the last credit downswing occurred between 1984 and 1988. Problems at Asia Trust Bank in 1984 and two other commercial between 1985 and 1987 were responsible for this decline. It is noteworthy here that during this downswing, nominal bank credit merely slowed and its yearend growth rate never fell below 5% during the entire episode.

The recent credit cycle started in 1988 when the Thai economy embarked on a spectacular growth path. Compared to previous credit cycles, the most recent cycle is the most dramatic in both upswing and downswing. Although it took several years for the private credit-to-GDP ratio to return to its trend (the initial recovery was hit by the soft landing of the economy in 1991), the private credit-to-GDP ratio increased almost non-stop between 1992 (the first year of Thailand's financial liberalization) and 1997. The sharp run-up in the private credit-to-GDP ratio was followed by an even sharper decline. In three years, the private credit-to-GDP went from 20% above the trend to 12% below. This precipitous decline in private credit has led many observers to believe that Thailand has slipped into a credit crunch, a topic in which we will explore in more detail in the next two sections.

3. Aggregate (Macro) Level Analysis

A slowdown or contraction in bank loan growth could result from either demand or supply factors. In an equilibrium situation, interactions between loan supply and loan demand determine observed quantity and market-clearing interest rate. Leftward shifts in supply and demand curves both cause observed credit quantity to decrease, but where the interest rate will end up from the original equilibrium level depends on whether supply or demand shifts dominate. If shifts in supply dominate, the new equilibrium interest rate will be higher than the old one. The opposite holds when shifts in demand curve dominate.

As the Asian financial crisis went into full force in 1998, a question of whether the affected Asian countries were in a credit crunch situation became widespread. This early speculation was prompted by an observation of a sharp contraction in private credit amidst extraordinarily high levels of interest rates. Yet, a credit crunch goes beyond a typical leftward shift in the supply curve. The U.S. Council of Economic Advisors defines a credit crunch as a situation in which "the supply of credit is restricted below the range usually

identified with prevailing market interest rates and the profitability of investment projects." In other words, a credit crunch is a disequilibrium situation where interest rates do not equilibrate supply and demand and there is quantity rationing[8]. Thus, simply seeing a reduction in observed loan quantity accompanied by increases in interest rate is not sufficient to conclude that there is a credit crunch.

Identifying the existence of a credit crunch is important for policymakers because a credit crunch has a much more damaging effect on the economy than a simple leftward shift in loan supply. Most importantly, a credit crunch indicates a severe credit market failure in which some creditworthy borrowers are denied loans even when they are willing to pay a higher interest rate. As a result, a credit crunch not only exacerbates an economic downturn but also delays an economy recovery. Additionally, a credit crunch lessens the effectiveness of monetary policy. When bank credit supply is constrained, the credit channel of monetary transmission will not be fully operative. This adverse impact of a credit crunch on monetary policy is likely to be severe in countries that depend heavily on bank finance such as Thailand.

This section and the next one share the same objective, namely to identify whether there is a credit crunch or any supply constraints on the part of the banks during the recent episode of bank lending contraction. In each section, we begin with a brief review of the relevant literature followed by description of our methodology and the empirical results.

3.1. Literature review

Empirical research on credit crunch and/or supply-based credit contraction using aggregated level data is abundant. In the case of Thailand, approaches vary and so do the results. Agenor, *et al*. (2000) develop and estimate a model of banks' demand for excess reserves and conclude that contraction of bank lending in Thailand was basically a supply driven phenomenon. Their conclusion is based on an argument that a demand-driven credit contraction would result in a significant divergence between estimated and actual excess reserves (*i.e.*, "involuntary" accumulation of reserves), in which they do not find.

[8] Alternatively, a credit crunch can also be viewed as the aggravation of an adverse selection problem (Stilglitz and Weiss, 1981)

In another widely cited study, Domac and Ferri (1999) attempt to investigate the existence of credit crunch in East Asia by looking directly at the evolution of key monetary and credit variables. They claim that if there were credit crunch, one would observe a reduction in credit growth together with a widening spread between the lending rate and the risk-free rate. They find that, in contrast to the experience of other East Asian countries, Thailand did not face a credit crunch.

More recently, assuming that the Thai credit market was in equilibrium before the 1997 crisis, Kotikula, *et al*. (2001) use pre-crisis estimates of credit supply and credit demand functions to project post-crisis supply and demand paths. Their result shows alternating roles of credit supply and demand. Specifically, they find supply constraint to be significant in 1997 Q4. Demand constraint then took over in 1998-9 before yielding to the supply constraint again for the entire 2000.

This paper follows an alternative approach that has recently found an increasing use by IMF and World Bank researchers – a disequilibrium econometric (switching regression) estimation. Because a credit crunch by definition concerns a disequilibrium situation, this approach seems to fit naturally with our purpose. Early use of this approach can be found in Laffont and Garcia (1997) for Spain, Sealey (1979) for the United States, and Ito and Ueda (1981) for Japan. Recent work has been done for Finland (Pazarbasioglu), Korea (Ghosh, 1998; Kim, 1998), East Asia (Ghosh and Ghosh, 1999), and Latin America (Barajas and Steiner, 2002). Previous result for Thailand, based on the work of Ghosh and Ghosh (1999), indicates that collapsing credit demand was the main culprit behind bank credit contraction.

3.2. Methodology

In essence, Section 3 can be considered an extension of Ghosh and Ghosh (1999) whose sample period ends in June 1998. The econometric framework that we adopt here is basically an estimation of a system of loan supply and demand functions under the assumption that, at any given point in time, the bank loan market may either be in equilibrium or exhibits temporary excess demand or supply owing to imperfect flexibility (stickiness) of interest rate in the short run.

When the interest rate does not adjust sufficiently to clear the market, the disequilibrium hypothesis is that the "short side" of the market prevails:

$$L_t = \min(L_t^s, L_t^d),$$

where L_t is the actual quantity of bank loans observed at time t, and L_t^s and L_t^d are the credit supply and loan demand functions, respectively.

Define L_t^s and L_t^d as functions of vectors of explanatory variables X_{1t} and X_{2t}, and error terms:

$$\begin{aligned} L_t^s &= X_{1t}'\beta^s + u_{1t}, \\ L_t^d &= X_{2t}'\beta^d + u_{2t}. \end{aligned}$$

As Maddala and Nelson (1974) show, in the absence of information on the interest rate adjustment process, and assuming that the errors u_1 and u_2 are normally distributed, the model allows the determination of the probabilities with which each observation belongs to the supply or demand functions. The system can then be estimated via the method of maximum likelihood estimation.

Let λ_t be the probability that an observation at time t is supply constrained (*i.e.*, there is an excess demand) and $g(\cdot,\cdot)$ be the joint density function of u_1 and u_2, then the density function for L_t under the assumption of binding supply constraint can be written as

$$h(L_t | L_t = L_t^s) = \frac{\int_{L_t}^{\infty} g(L_t^d, L_t)\, \mathrm{d}L_t^d}{\lambda_t}.$$

Likewise,

$$h(L_t | L_t = L_t^d) = \frac{\int_{L_t}^{\infty} g(L_t, L_t^s)\, \mathrm{d}L_t^s}{1-\lambda_t}.$$

The unconditional density function is then

$$\begin{aligned} h(L_t) &= \lambda_t h(L_t | L_t = L_t^s) + (1-\lambda_t) h(L_t | L_t = L_t^d) \\ &= \int_{L_t}^{\infty} g(L_t^d, L_t)\, \mathrm{d}L_t^d + \int_{L_t}^{\infty} g(L_t, L_t^s)\, \mathrm{d}L_t^s . \end{aligned}$$

The associated log likelihood function is

$$
\begin{aligned}
ML &= \sum_{t=1}^{T} \log h(L_t) \\
&= \sum_{t=1}^{T} \log \left[\begin{array}{l} \frac{1}{\sqrt{2\pi}\sigma_1} \exp\left(-\frac{1}{2\sigma_1^2}\left(L_t - X_{1t}'\beta^s\right)^2 \right) * \frac{1}{\sqrt{2\pi}\sigma_1} \int_{L_t}^{\infty} \exp\left(-\frac{1}{2\sigma_1^2}\left(L_t^s - X_{1t}'\beta^s\right)^2 \right) dL_t^s \\ + \frac{1}{\sqrt{2\pi}\sigma_2} \exp\left(-\frac{1}{2\sigma_1^2}\left(L_t - X_{2t}'\beta^d\right)^2 \right) * \frac{1}{\sqrt{2\pi}\sigma_2} \int_{L_t}^{\infty} \exp\left(-\frac{1}{2\sigma_2^2}\left(L_t^d - X_{2t}'\beta^d\right)^2 \right) dL_t^d \end{array} \right],
\end{aligned}
$$

where σ_1 and σ_2 are standard deviations of u_1 and u_2, respectively. The second equality follows directly from the normality assumption of u_1 and u_2.

Specification of the credit supply equation. Because changes in the observed quantity of credit can be attributed to movements in either credit demand or credit supply or both, we have here a classic identification problem. To resolve the identification issue, the paper follows the recent literature in using lending capacity to distinguish the credit supply function from the credit demand function. The assumption is that, lending capacity, defined as the sum of the banking system's deposits and other liabilities less required liquid assets that the banks need to hold, affects supply, but not demand for bank credit. As for the exogeneity assumption, it is reasonable to believe that, in a short run, banks have little discretionary clout to influence their lending capacity.

In practice, banks face an additional constraint when they decide to lend. A bank must hold a certain amount of capital to meet the minimum BIS requirement. Equivalently, there is a maximum amount of credit that a bank can lend out given its capital account. To capture this capital constraint, we define an effective lending capacity as

Effective lending capacity = min (unconstrained lending capacity, maximum amount of credit implied by BIS rules[9])

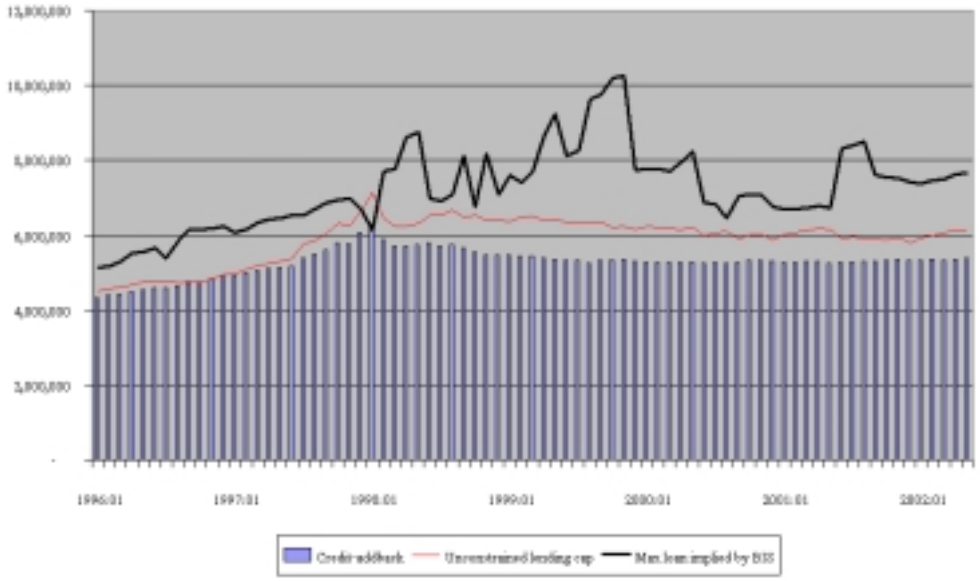
It should be noted that the above formulation only capture the "ability to lend" part of the BIS constraint. In reality, banks may and do choose to hold capital beyond the minimum BIS requirement if they think their existing loans may turn sour in the future. Thus, there is

[9] Specifically , the implied maximum credit at time *t* is approximated by:
(Thai banks' BIS capital/Thai banks' BIS ratio + foreign branches' BIS capital/foreign branches' BIS ratio)$_t$ x (actual loans extended/actual risk assets)$_t$

also the "willingness to lend" part of the BIS constraint. In Section 4, we investigate the the relationship between the BIS constraint and bank lending from a different angle to ensure that both parts of the BIS constraint are taken into consideration.

Figure 8 plots the unconstrained lending capacity against the maximum amount of credit implies by BIS rules from 1993 to May 2002. The plot suggests that the banking system as a whole has almost never had problems in complying with capital regulation. The only exception happened in February 1998 when the government intervened in two troubled commercial banks.

Figure 8. Unconstrained lending capacity, maximum credit implied by BIS rules, and private credit, 1996:01-2002:05



Sources: Bank of Thailand; authors' calculation

As the first pass at the supply-or-demand question, Figure 8 also shows movements of actual private credit. It is noteworthy that before the crisis broke out in 1997, the banking system' lending capacity tracked the observed credit quantity quite closely. This relationship began to break down post June 1997. Although the banking system's lending capacity experienced a sharp decline similar to the observed credit in 1998, it remains well above the latter for the rest of the sample period.

Nevertheless, between January 1998 and May 2002, the banking system's lending capacity declined by 14%. While commercial banks' total deposits increased by more than

20% over this period, commercial banks' borrowing declined by a whopping 75%. Decreases in foreign borrowing accounted for much of the decline[10].

In addition to the effective lending capacity variable, the credit supply function is assumed to depend on the lending rate, the deposit rate (as a proxy for the banks' cost of fund), the stock market index (as a proxy for expectations about the future economic condition as well as the value of collateral), and the manufacturing production index or MPI (as a proxy for firms' ability to pay). These variables are meant to capture banks' willingness to lend as opposed to banks' ability to lend captured by the effective lending capacity.

Specification of the credit demand equation. On the demand side, we assume that the real demand for credit depends on the lending rate, the stock market index, MPI (as a proxy for current output), the output gap (measured as the deviation of current MPI from its HP trend[11]), consumption (as measure by the Bank of Thailand's private consumption index), and expected investment (as measured by the Bank of Thailand's private investment index). The use of expected investment instead of actual investment follows a similar treatment by Pazarbasioglu (1997). The idea is to avoid a problem arising from inclusion of an explanatory variable that may reflect eventual rationing.

Other specification issues. The change in the exchange rate regime in 1997 suggests that there could be a potential structural break in the data. To cope with this problem, we add a crisis dummy variable (= 0 up to June 1997 and = 1 from July 1997 onwards) to both the credit supply and credit demand equations. It turned out that the crisis dummy variable is not statistically significant in the demand equation and its omission has almost no effect on the estimated demand and supply functions. For this reason, we include the dummy variable only in the credit supply equation.

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[10] Except for the beginning (1997-8) in which foreign creditors called in loans to commercial banks, a lot of the reduction in foreign borrowing can be attributed to conversion of foreign currency loans into Baht loans by domestic firms which in turn precipitated commercial banks' repayment of their foreign borrowings.

[11] As in Ghosh and Ghosh (1999), we include the output gap term to make sure that the estimated result is not biased towards credit crunch. The rationale is that in difficult times, firms may seek greater credit financing. Inclusion of this variable in the estimation ensures that the estimated credit demand does not fall simply because of output collapse.

As a final note on specification, there is an issue of stationarity in the data. The augmented Dickey-Fuller test fails to reject the null hypothesis of no unit root for real private credit. Yet, to estimate the model using first differences would lose too much information. Specifically, having the growth in credit supply exceeding the growth in credit demand does not necessary mean that supply is not a binding constraint. As in the recent literature, we get away with the unit root problem by showing that the estimated demand and the estimated supply functions each form co-integrating vectors with the observed real private credit.

3.3 Estimation results

As in most of the previous work on disequilibrium estimation, we use monthly data in our analysis. Our sample period runs from 1993:01 through 2002:05. Data sources and descriptions are given in Appendix B.

All regressions are estimated in real terms. We use rate of annual changes in the consumer price index to deflate nominal variables except for the case of real interest rates in which we use 6-period ahead inflation. Out-of-sample inflation rates are projected using an autoregressive process, the same procedure we use to formulate out-of-sample investment.

To partially deal with the endogeneity problems, most of our independent variables are in lagged or moving average terms. Finally, except for the interest rate variables, all independent variables are taken in natural logarithm so that their coefficients can be directly interpreted as elasticities.

Table 2 reports the estimation results. The second column reports coefficient estimates of respective independent variables while the third column reports the estimates' asymptotic z-statistics and their significant levels. Also reported in Table 2 are the adjusted R^2s of the OLS regressions we use to find the initial values for our maximum likelihood estimation.

Table 2. Estimation results

Variable	Coefficient	Z-statistic
Supply function		
Constant	0.644	2.10***
Lending rate	0.021	4.58***
Deposit rate	-0.002	-0.60
Lending capacity	0.728	23.26***
Manufacturing production	0.434	11.30***
Stock market index	0.007	0.44
Crisis dummy	-0.014	-1.84**
Adjusted OLS R^2: 0.989		
Demand function		
Constant	9.187	2.43 ***
Lending rate	-0.015	-7.12 ***
Stock market index	-0.051	-0.70
Manufacturing production	-1.657	-2.99 ***
Output gap	0.468	0.93
Consumption	0.922	5.73 ***
Expected investment	-0.024	-0.54
Adjusted OLS R^2: 0.864		

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level

Results from Johansen cointegration test indicates that our estimation based on levels is indeed valid. For the estimated supply-actual credit pair, the trace statistic (λ_{trace} =30.5) is significant at 1% level. For the estimated demand-actual credit pair, the trace statistic (λ_{trace} = 17.4) is significant at 5% level.

All of the credit supply function's coefficient estimates have the expected signs. As in previous studies on Thailand and other countries, lending capacity is the most significant determinant of the estimated credit supply function. A higher lending rate is associated with greater credit supply and a higher deposit rate has an opposite (though small and insignificant) effect. As for the "willingness to lend" variables, MPI enters the supply equation with a significant and sizable positive coefficient. As economic prospect improves, banks are more willing to lend. The stock market has the expected positive sign, but as in the case of the deposit rate, the coefficient is small and insignificant. Finally, the negative and

significant coefficient of the crisis dummy variable suggests that the banks' willingness to lend has been reduced by the financial crisis.

On the demand side, a higher lending rate is strongly associated with lower credit demand. The coefficient of the stock market index is negative and insignificant. As Ghosh and Ghosh (1999) explain, this might be the result of two opposing forces at work. On the one hand, a higher stock market index indicates a better economic outlook and hence a positive impact on credit demand. On the other hand, a higher stock market index means a greater opportunity for firms to tap equity financing, which in turn reduces credit demand.

Two coefficient estimates have unexpected signs: expected investment and MPI. Because the coefficient of expected investment is both small and insignificant, we can easily disregard it[12]. On the other hand, the negative and significant coefficient of MPI is puzzling. One plausible explanation of this finding is that the estimated coefficient may be dominated by the observed divergence between movements in MPI and real private credit which started in early 1997. Indeed, results from the Bank of Thailand' recent survey of manufacturers indicate that the surge in MPI post crisis has been funded by non-bank sources (most notably retained earnings and loans form the surveyed firms' parent companies). Firms then use earnings from increased production to deleverage their debt. We believe however that the disconnection between MPI and bank credit demand will eventually be reversed, most likely when the economic prospect becomes stronger. But in the meantime, we will have to accept this unpleasant result[13].

The positive coefficient of the output gap can be interpreted that Thai firms do not seek greater funding in bad times. This is an expected result when the output gap is highly positively correlated (a simple test of the data reveals that this is indeed the case). If firms expect the negative output to widen further, they may not increase financing just because they see output falling below its trend.

Finally, private consumption strongly contributes to credit demand. Our estimated credit demand function increases almost one-for-one with an increase in private consumption.

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[12] Nonetheless, the negative coefficient of expected inflation is consistent with our explanation of MPI coefficient.

[13] Two good control variables come to our mind: the capacity utilization rate and operating margins of listed firms. Unfortunately, the former is available only from 1995 while the latter is available in quarterly form.

The strong association between consumption and credit demand suggest that banks' current emphasis on consumer finance is hitting the right target of customers.

Figure 9. Natural logs of estimated real credit supply and estimated real credit demand functions

Source: Authors' calculation

Figure 9 plots the estimated credit supply and demand functions based on the coefficients reported in Table 1. Three interesting inferences can be drawn from this figure. First, the year 1997 appeared to be characterized by increased credit rationing, with the estimated credit supply function increasing at a slower pace than the estimated credit demand function. This finding suggests that the banking sector's supply problem started before the precipitous decline in real private credit in January 1998. Second, the decline in credit supply appeared to precede the decline in credit demand by about three months. The behavior of the estimated credit demand function in the first quarter of 1998 is consistent with the notion of firms desperately scrambling for needed liquidity. To us, this is the evidence of a credit crunch in Thailand. Third and most importantly, from 1999 onwards, credit supply and credit demand seemed to be moving together in the same direction. The occasional supply-demand imbalances are small relative to what we see in early 1998, indicating a more or less equilibrium situation.

It is noteworthy here that our result is a complete opposite of Ghosh and Ghosh (1999) who find that the decline of private credit in Thailand was mainly demand driven.

Although different specifications (for example, we use CPI to deflate nominal variables while they use PPI) may play some role, it seems that the different results arise from different sample periods used– their sample ended in 1998 while our in May 2002. Indeed, we are able to replicate their finding of a demand-driven credit contraction (results available upon request) when we change the end date of our sample to theirs.

As a final exercise in this section, Table 3 presents the decomposition of the estimated changes in credit supply and credit demand during the credit contraction period. This analysis is based on a similar exercise by Barajas and Steiner (2002) in the case of Latin America. The decomposition *excludes all changes brought about by adjustment in lending and deposit interest rates* and focuses instead on predicted shifts in the supply and demand curves. We break down changes in supply into two categories: ability to lend (lending capacity) and willingness to lend (manufacturing production and the stock market index[14]). We then define the predicted change in each case as the change in the respective independent variable during the period multiplied by the its estimated coefficient.

Table 3. Decomposition of estimated changes in credit demand and credit supply, 1998:01-2002:05

	Full period	Subperiod		
	98:01-02:05	98:01-98:12	98:12-00:12	00:12-02:05
Estimated shift in the supply curve				
Ability to lend	(0.08)	(0.02)	(0.06)	0.00
Willingness to lend	0.09	(0.02)	0.10	0.01
Total	0.01	(0.04)	0.04	0.01
Estimated shifts in the demand curve				
Total	(0.17)	(0.01)	(0.15)	(0.01)

Sources: Table 2 and data sources used in estimation

The results from Table 3 indicate that by the end of our sample period, the estimated credit supply curve has more or less moved back to its January 1998 position[15]. The initial

[14] By construction, the crisis dummy represents a one-time supply curve shift in July 1997.

[15] That the estimated supply curve has moved back to its original position is not inconsistent with the result shown in Figure 9. The readers should be reminded that one excludes the effect of interest rate changes while

leftward shift in the supply curve was mitigated by a subsequent rightward shift. For the entire contraction period, banks' willingness to lend contributed positively to the estimated supply function while lending capacity was a negative supply contributor. As mentioned earlier in this section, commercial banks' capital outflow accounted for much of the decline in lending capacity. It must be stressed however that the result for the 2000:12-2002:05 subperiod indicates that lending capacity is no longer a major constraining factor of credit supply. On the demand side, we find a significant downward shift in the demand curve for the entire contraction period but little movement during the 2000:12-2002:05 subperiod.

While we believe that our model captures reasonably well what happened behind the contraction of private credit in Thailand, we would like to emphasize that our results are only indicative. Data unavailability precludes us from using two theoretically important credit supply determinants in our estimation: NPLs and loan loss provisions requirement[16]. The former reflects banks' actual and potential losses while the latter reflects the severity of regulations on risk taking in bank lending activities. In their study of credit slowdown in Latin America, Barajas and Steiner (2002) find that the two variables do contribute negatively to their estimated supply functions. Although our use of the crisis dummy variable in the supply equation partially fixes this potential misspecification problem (as judged by the sign and size of the dummy), the crisis dummy obviously cannot explain all the supply variations arising from the missing variables.

Another reason we do not want to base our conclusion solely on the macro findings is possible susceptibility of the disequilibrium model to different specifications. The most striking example comes from the case of Korea. Kim (1998) and Ghosh and Ghosh (1999) use virtually the same sample period but reach opposite conclusions of whether there was a credit crunch in Korea. Although we reach the same conclusion of a supply-driven credit contraction in all the specifications we try, there is no guarantee that if variables such as

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the other does not. The declining interest rate environment obviously contributed to reduced bank credit supply.

[16] Prior to December 31, 1998, financial institutions were required to classify their impaired assets into 3 categories: substandard, doubtful, and loss with loans being considered impaired or substandard (non performing) after being delinquent for 6 month. Beginning with the accounting period ending on December 31, 1998 onward, financial institutions were required to classify and provision for their assets both on- and off-balance sheets according to the obligors' financial condition and debt repayment capacity as well as the length of non-payments. Under the new rules, a loan which is 3 month overdue must be classified as substandard at the minimum. Since 2000, hybrid instruments with characteristics defined by the Bank of Thailand have been allowed to be counted as capital requirement.

NPLs were available, our result would still hold. Therefore, we need a complementary analysis to support out macro findings, which brings us to the micro level analysis of the next section.

4. Disaggregate (Micro) Level Analysis

Inability to use NPLs and loan loss provisions data in the econometric estimation represents the biggest void in our macro level analysis. Most importantly, the lack of consistent time series data on the two variables prevents us from getting a clear picture of supply-side constraints. The purpose of this section is to fill in this void. Using individual banks' data from the shorter, post-crisis period, this section attempts to shed some light on what remains unclear from the macro level analysis.

4.1. Literature Review

Most of the empirical research on supply-based loan contractions, using disaggregated level data, relates to the experiences of developed countries. These studies seek to measure a relationship between indicators of bank financial condition and its lending behavior. Bernanke and Lown (1991) demonstrate a link between bank capital and lending by conducting a cross-sectional regression, using state-level data in the U.S. during the recession period of 1990-1991. Controlled for economic growth in different states, they find that a fall in the ratio of capital to asset reduces loan growth in subsequent period. They also examine data on 111 individual banks in the state of New Jersey where the credit crunch was alleged to be most severe, indicating similar results. Hancock, Laing, and Wilcox (1995) argue that large losses experienced by U.S. banks in the early 1990s implied a negative shock to bank capital. They find evidence not only that bank lending declined in response to such capital shock but also that banks altered their portfolio composition. Nevertheless, Berger and Udell (1994) offer alternative results. The study use regression analysis on panel data of nearly all insured U.S. banks during 1979-1992 amounted to over one-half million observations. They find that most of the supply-side variables including risk-based capital, leverage capital, and voluntary-risk retrenchment did not have significant impact on credit reallocation from loans to securities. The only evidence consistent with credit crunch hypothesis was the difference

in regulatory agency and loan loss provision policy, that is large banks with weaker capital ratios, and banks supervised by the OCC have much more substantial credit reallocation. Demand side variables including macro/regional economic variables and declining trend of bank intermediation play relatively stronger roles.

Tallman and Bharucha (2000) analyze the 1986-1993 credit cycle in Australia, focusing on lending behavior of banks during the downswing of the cycle. Due to data limitation on loan impaired assets and small number of banks in Australian[17], they use non-econometric analysis and found evidence of supply side credit crunch. In particular, banks with relatively high levels of impaired assets experienced a relatively sharp decline in loan growth and a portfolio shift from commercial loan to housing loan which has lower risk weight in the BIS capital ratio requirement.

4.2. Methodology

As of May 2002, there are total of 30 commercial banks operating in Thailand, of which 12 are locally incorporated[18] and 18 are branches of foreign banks. These 12 locally incorporated banks consist of 5 private banks, majority owned by Thai; 4 private banks, majority owned by foreigners; and 3 state owned banks.[19] (See Table 4.) Similar to Australian banking sector in which its four largest banks account for about 70 % of total bank loans, the Thai banking sector is also to some extent concentrated as loans extended by five largest banks account for about 63 % of total banking sector's loans in May 2002.

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[17] Australian banking sector is highly concentrated relative to that of the United States; only thirty one Australian banks operated continuously during the downturn in the 1986-93 credit cycle, compared with many thousands of banks in the United States. Australian four major banks account for 70 percent of total bank lending while the six U.S. money center banks hold only around 25 percent of total U.S. bank assets. (Tallman and Bharucha, 2000, page15)

[18] Excluding Thanachart, a restricted-licensed bank which is permitted to engage in all commercial banking activities with the exception that it cannot offer checking deposits. The restricted-licensed bank may, after a period of operation, apply for a full-licensed bank status under conditions set by the Ministry of Finance. (Bank of Thailand, 2000)

[19] Classified by 50 percent of ownership structure.

Table 4. Number of banks, finance companies, and credit foncier companies in Thailand

End-Period	1996	1997	1998	1999	2000	2001	May 2002
Full-licensed Banks	15	15	13	13	13	13	12[1]
Foreign Bank Branches	14	20	21	21	21	18	18
Finance Companies	91	35	36	22	21	21	19
Credit Foncier	13	12	12	10	10	9	6

[1]Excluding Thanachart Bank which is a restricted-license bank

Given a small number of banks in Thailand, the study of bank conditions and their lending behavior cannot be done using cross-sectional regression analysis, as in the case of U.S. banks which comprise many thousands. Time series estimation is also not possible, due to changes in definitions of non-performing loans and loan loss provision requirement over time, as aforementioned. Thus, this study uses a non-econometric approach along the line of Tallman and Bharucha (2000) in analyzing whether these two variables, which are main supply side variables but not included in macro data analysis, contributed to loan contraction in Thailand during the period of 1998-2001.

If banks face similar loan demand conditions, differences in the size and composition of bank assets should reflect decisions made by individual banks which are supply-side factors. In particular, banks with higher NPLs and loan loss provision are more likely to have

1) higher rate of loan contraction and/or
2) loan portfolio shift from loans with higher perceived risk or regulatory risk weight to loans with lower perceived risk or regulatory risk weight.

The above argument of bank lending behavior can be captured by a simple mathematical decomposition of capital ratio as follows.

The BIS capital ratio (k) is defined as

$$k = K/A^* \quad (1)$$

where K is the capital base and A* is risk-weighted assets. Thus, changes in a bank's BIS capital ratio can be decomposed into three elements: 1) changes in the bank's capital base, 2) changes in the bank's total assets, and 3) changes in the composition of those assets.

For simplicity, it is assumed that there are two assets and that one of the assets has a concessional risk weight of θ, less than one, while the other has a risk weight of one. Therefore,

$$A^* = \theta A_1 + A_2, \quad 0 <= \theta < 1 \tag{2}$$

where A_1 and A_2 are the two assets. This calculation can also be expressed as

$$A^* = [1- w (1 - \theta)] A \tag{3}$$

where A is total assets ($A_1 + A_2$) and w is the portfolio share of the asset attracting the lower risk weight.

Substituting (3) into (1) and totally differentiating yields

$$dk = dK/A^* - KA^{0} + K [(1-\theta)) /1- w(1-\theta)] dw \tag{4}$$

where a dot (^{0}) above a variable denotes a percentage change.

Equation (4) implies that the capital ratio will increase if capital increases, if total assets decline, or if there is a portfolio shift toward the asset with the concessional risk weight. The lower the concessional risk weight (θ) is, the larger the effect will be on the capital ratio of a given change in the structure of a bank's portfolio.

Note that, following the BIS capital adequacy guidelines, the Bank of Thailand requires Thai commercial banks, foreign bank branches, and finance companies to maintain capital to risk-weighted asset ratio of not less than 8.5, 7.5, and 8.0 percent, respectively. Among this total capital required, not less than half must be tier 1 capital, for the case of Thai commercial banks and finance companies.[20] For risk-weighted assets, four risk weights; 0, 0.2, 0.5, and 1, are assigned to four categories of assets according to their risk characteristics as follows.

Assets with a "0" risk weight include mainly cash, deposits at the Bank of Thailand, investment in the repurchase market, loans to or loans guaranteed by, and investment in securities issued by the Thai government, the Bank of Thailand, government and central

[20] Tier 1 capital includes paid up capital, share premium, statutory reserve**,** reserves after appropriated from net profit at the end of each accounting period, net profit after appropriation, and preferred stock with characteristics as required by the Bank of Thailand. Tier 2 capital includes reserve arising from asset appropriation, provision for assets classified as pass, subordinated debt and hybrid instruments with characteristics as required by the Bank of Thailand. (see Notification of the Bank of Thailand no.FPG (31) C.1672/2545 on the BOT webside: www.bot.or.th for details of capital requirement)

banks in OECD countries, FIDF, Krungthai Bank's deposits and Krungthaithanakit's promissory notes under 56 Finance Companies' Notes Exchange Program.

Assets with a "0.2" risk weight include mainly deposits at, loans to or loans guaranteed by, and investment in securities issued by commercial banks, finance companies, credit foncier companies, Government Saving Bank, Government Housing Bank, Bank for Agriculture and Agricultural Cooperatives, Export-Import Bank of Thailand, State enterprises, commercial banks in OECD countries, international organization as specified by the Bank of Thailand.

Assets with a "0.5" risk weight include mainly loans to or loans guaranteed by, and investments in securities issued by local municipal, and housing loans provided to individuals.

Assets with "1" risk weight include mainly loans to private sector, land, building, equipment, and other fixed assets.

In summary, to examine whether loan contraction during the crisis was also a result of supply side variables or bank's condition, we will first identify banks that face similar demand, then investigate their balance sheet conditions and relationship with lending behavior (loan contraction rate and loan portfolio composition) as described above.

4.3. Empirical Evidence

To empirically investigate the relationship between bank condition and its lending behavior for the case of Thailand as indicated above, we proceed with the following procedures.

1) Identify group of banks with similar demand.

   Variables that help identifying banks with similar demand for loans include size and composition of loans, branch network or number of ATMs which are regarded as more important delivery channels, especially for banks that target retail customers, compared to those that target corporate customers. Although operating the same types of business as the 12 banks, foreign bank branches incorporated in Thailand are allowed to have only one branch. Therefore, it is more likely that their main customers are corporate, given that technology penetration rate in Thailand remains relatively low and many customers still prefer to have face to face transaction with the bank's staffs rather than the machine. Therefore, it is

reasonable to assume that 18 foreign bank branches face different demand from 12 locally incorporated banks. These 12 locally incorporated banks that are allowed to have branches throughout the country can be classified into 3 groups, according to ownership structure as

Group 1) private Thai bank, majority owned by Thai

Group 2) state owned banks, majority owned by the government.

Group 3) private foreign bank, majority owned by foreigners.

Considering loan market share and number of branches (Table 5), these three groups of banks can be assumed to have different types of loan demand. Each of banks in Group 1 has loan market share of more than 5 % and more than 300 branches nation wide while those in Group 3 has market share of less than 3 % and less than 120 branches.

Table 5. Commercial Bank's Market Share of Loans, Asset Size, and Number of Branches[1/]

		Loan Size[2/] (% of Total Bank Loans)	Asset Size (% of Total Bank Assets)	Number of Branches
		Jun-02	Jun-02	Jun-02
Group 1	Bangkok Bank	18.1	21.5	576
	Thai Farmer Bank	12.0	13.4	498
	Siam Commercial Bank	11.8	12.3	479
	Bank of Ayudhya	9.5	7.7	385
	Thai Military Bank	7.8	6.4	358
Group 2	Krung Thai Bank	20.1	17.9	612
	Siam City Bank	9.1	8.7	371
	Bank Thai	3.2	4.7	79
Group 3	Bank of Asia	2.7	2.8	120
	DBS Thai Danu Bank	2.1	1.7	61
	Standard Chartered Nakornthon	1.4	1.1	40
	UOB Radansin Bank	1.4	1.0	37
	Total Thai Banks	100.0	100.0	3,616

Sources: Call Report: CB1.1 available on Bank of Thailand Website

Notes: [1/]Excluding Thanachart Bank, a restricted licensed bank

[2/]Loans net of loan loss reserves

Although Krung Thai Bank has a comparable number of branches and a market share as private Thai banks in Group 1, its nature is closer to banks in Group 2 since Krung Thai and the banks in Group 2 are state owned, occasionally extend loans in response to government policy, and all involved in the authorities' intervention process. Assets of two failed banks, Bangkok Bank of Commerce (BBC) and First Bangkok City Bank (FBCB) were transferred to Krung Thai Bank (KTB) after their operations were closed in 1998.[21] Bank Thai was created as a result of consolidation among 5 failed finance companies, Union Bank of Bangkok (UBB) which were intervened in August 1998, and 7 finance companies which were intervened earlier and were consolidated with Krung Thai Thanakit Finance (KTT). (Bank of Thailand, 2000). Bangkok Metropolitan Bank were merged with Siam City Bank in April 2002.

Thus, we will analyze relationship between bank condition and its lending behavior of banks in Group1 which account for about 60% of total 12 bank loans, based on the argument that all banks in Group 1 have similar demand condition. We focus on behavior of banks in Group 1 since its share in bank lending is the largest. Although banks in Group 2 has increased its significance after the merger of intervened banks, accounting for about 32 % of total 12 bank lending, there is limitation in disaggregating data among the intervened banks in the analysis.

2) Identify balance sheet condition of banks in the same group

We use three variables as measures of bank condition followed existing literature as follows:

(1) Level of non-performing loans (NPLs) as percentage of total loans reflects actual and potential losses of the bank, thus required provisioning and capital constraint. According to the Bank of Thailand new provisioning requirements, starting from December 1998 accounting period, banks are required to maintain allowance for loan loss as a percentage of their classified assets. Assets classified as Pass, Special mention, Substandard, Doubtful, and Doubtful of losses are required to maintain at least 1%, 2%, 20%, 50%, and

[21] Good assets of BBC were transferred to KTB in October 1998 while all past-due debtors (NPLs) were left at the BBC which in turn was eventually converted into an AMC.

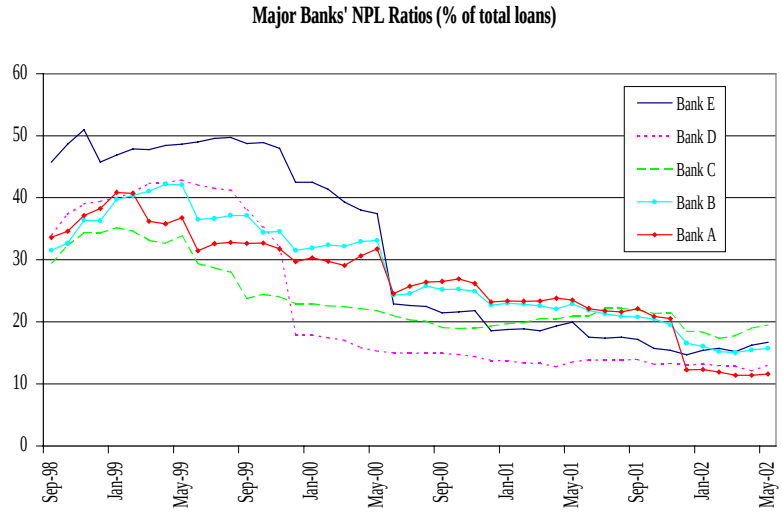
100% provision, respectively. Assets classified as Loss must be written off. NPL, defined as a loan with 3 month and overdue, is classified as substandard at a minimum. Thus a bank with higher percentage of NPLs in their loan portfolio is required to maintain higher level of loan loss provision net of collateral values, consequently tend to affect its capital condition. However, the NPLs variable may also reflect the bank's perceived risk on borrowers. With high percentage of NPLs, the bank may be reluctant to lend, fearing that new loans extended may be default.

(2) The ratio of existing allowances for loan losses to required allowances for loan losses. Banks were permitted to phase-in the new provisioning requirement as set forth by the new asset classification and provision rules beginning December 31, 1998 through December 31, 2000.[22] Therefore, during the period of 1998-2000, the existing allowance could be less than the required amount, in which the lower the ratio is more likely to indicate the bank's more capital constraint to meet regulatory requirement, thus contracting loans. However, when existing allowance is higher than required amount, the higher the ratio could reflect the bank's anticipation of future loan loss, so maintaining excess provision to cushion that loss. In this case, high ratio may indicate high anticipation of future loan loss, thus constraining new loan extension in subsequent period. Therefore, the ratio of existing to required allowance for loan loss could have either positive or negative impact on subsequent loan growth.

(3) The BIS ratio, the ratio of capital to risk based asset, a more direct measure of the bank's existing capital condition. A bank with existing BIS ratio closer to the minimum requirement is more likely to have constraint in extending new loans if its ability to raise capital is limited.

[22] Banks were required to maintain allowance for loan loss of at least 20%, 40%, 60%, 80%, and 100% of full required amount by December 1998, June 1999, December 1999, June 2000, and December 2000, respectively.

Figure 10. Major banks (banks in Group 1)' NPL ratios

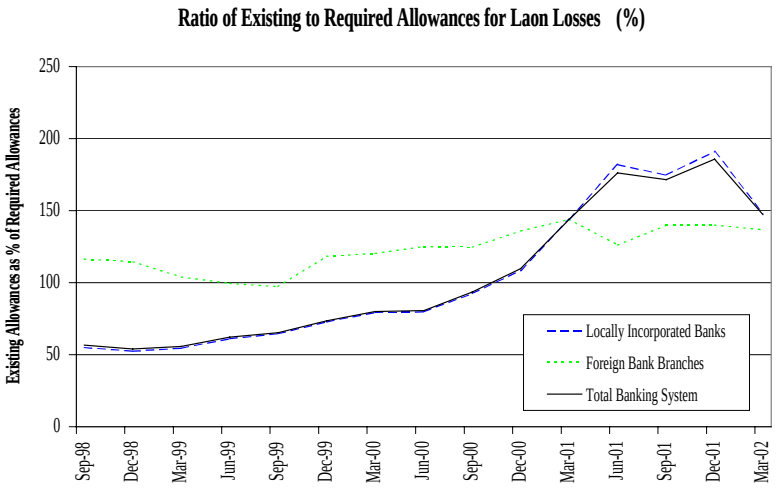


Source: The Bank of Thailand

Since individual bank's data on allowances for loan loss and BIS ratio are obtained from the bank's call reports sent to the Bank of Thailand as part of prudential regulations, they are confidential and cannot displayed here individually. We, however, show individual bank data with assumed name on NPL ratio which are available to the public. Five banks in Group 1 called Bank A, Bank B, Bank C, Bank D, and Bank E show some varieties regarding their NPL ratio, ranging approximately from 25% - 50% during 1998-1999 which was the period of substantial level of NPLs. Bank E's peak in NPLs ratio of 51% was the highest while Bank C's was the lowest of 35% Bank A, Bank B, and Bank D's NPL ratios reached their peak at about 40 %, however, Bank D's NPL ratio declined at a faster rate, from its peak in May 1999 to about 20% within six months.

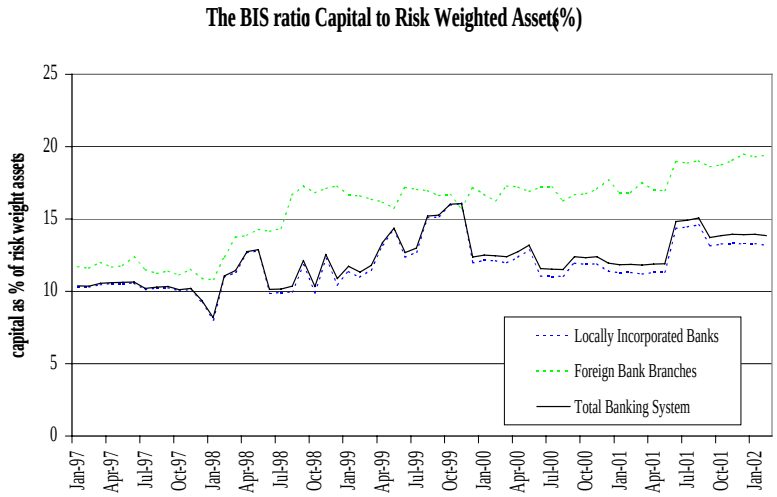
Figure 11. Ratio of existing to required allowance for loan loss, classified by type of banks

Source: Bank of Thailand



Aggregated level data on the ratio of existing to required allowance for loan loss shown in Figure 11 give us some picture on bank's capital condition. The 12 locally incorporated banks seem to be under capital constraint during the period of 1998 - 2000 in which the ratio of existing to required allowances for loan losses (full provisioning) was less than 100%. Since 2001 onwards, they seemed to have some relief on their capital pressure, partly due to financial sector restructuring measures introduced by the authorities, with an aim to address capital adequacy and distressed assets problems. Main measures include liberalization of foreign ownership, the government's capital support scheme (The August 14 Packages), recapitalization efforts using hybrid capital, and the establishment of private and national asset management companies. (See Appendix B for Timeline of each measure.) Individual bank data for the five banks in Group 1 are more or less consistent with aggregated data of locally incorporated banks. That is, all five banks have existing allowance for loan loss less than required amount, ranging from 46 % - 59 % in 1998, and 62 % - 102 % in 1999. However, the ratio for five all banks became more than 100 since 2000 onwards.

Figure 12 BIS ratio, classified by type of banks



Source: The Bank of Thailand

The BIS ratio of locally incorporated bank show increasing trend with fluctuation during 1998-1999 but became more or less stable about 12% during 2000. Individual bank data of the five banks in Group 1 show some variation, ranging from 9.8 % - 14.7 % in 1998, and 11.5 % - 17.6 % in 1999. However, the BIS ratio of these banks became about the same in 2000.

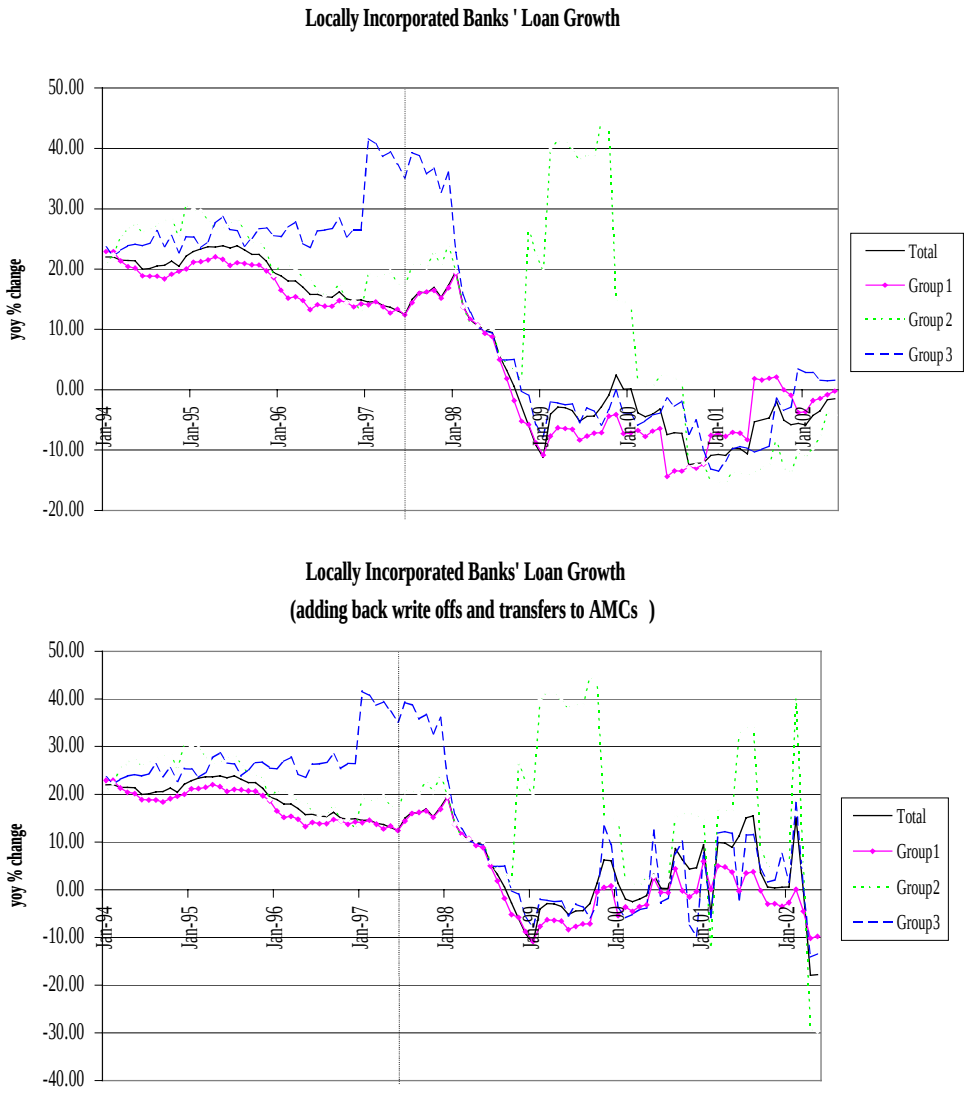
3) Lending behavior of banks within the same group.

3.1 Loan Growth Rate

When considering the impact of bank loans on the economy, ideally real value of "new" loans extended to non-financial institutions should be considered. Thus, to appropriately measure new loan extensions, write-offs and NPLs transfers to AMCs and TAMCs which were quite substantial during the period considered, should be added back to loans outstanding to keep pre-existing loan outstanding level constant, before considering the change. [23] Also to be consistent with loan data used in the macro level analysis, we use adding back series for individual bank data analysis.

[23] The change in the real value of loans outstanding is the sum of the real value of new credit extensions and the change in the real value of pre-existing loans. The second term is zero only if loans have instantaneous maturity and no write off or transfer of loans from bank's balance sheet. (Bernanke and Lown, 1991)

Figure 12. Growth in major banks lending (both for non-adding back and adding back for write-offs and transfers to AMCs series)



Sources: The Bank of Thailand

Since individual bank's data on loan growth (gross concept) are obtained from call report, we can only display in group level.[24] Though in the correlation analysis with bank condition, we use adding back series as explained, we display here both series for comparison purpose only. For non-adding back series, banks in Group 1's average loan contraction rate was deeper during the period of 1999-2000 (ranging from -5.8 % to -12 %) but became

[24] Data on individual bank loans are obtained from Call Report, Table 32 while bad debt write off and NPLs transfers are provided by Financial Institutions Analysis Division, Financial Institutions Policy Group.

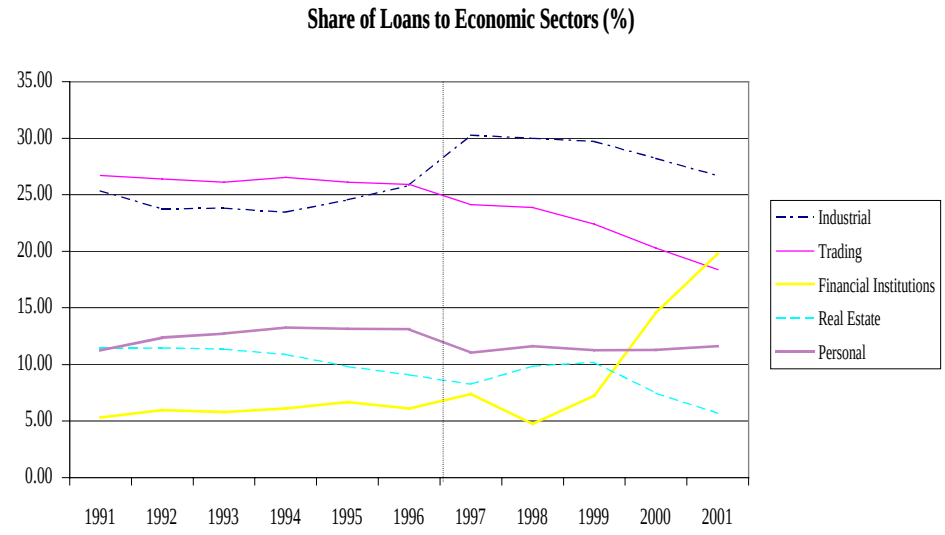
smaller in 2001 (ranging from -0.9 % to -7.5 %), compared to banks in the other two groups. Individual bank data indicate that three out of five banks in Group 1 started to experience positive loan growth during the first five month of 2002. Adding back series shows that banks in Group 1 experienced somewhat smaller rate of loan contraction in 1999 (ranging from -2% to -8%), compared to non-adding back. Four out of five banks had positive loan growth in 2001 but turned to negative growth again during the first five months of 2002. In sum, loan growth of banks in Group 1 show some variations during the period after the crisis.

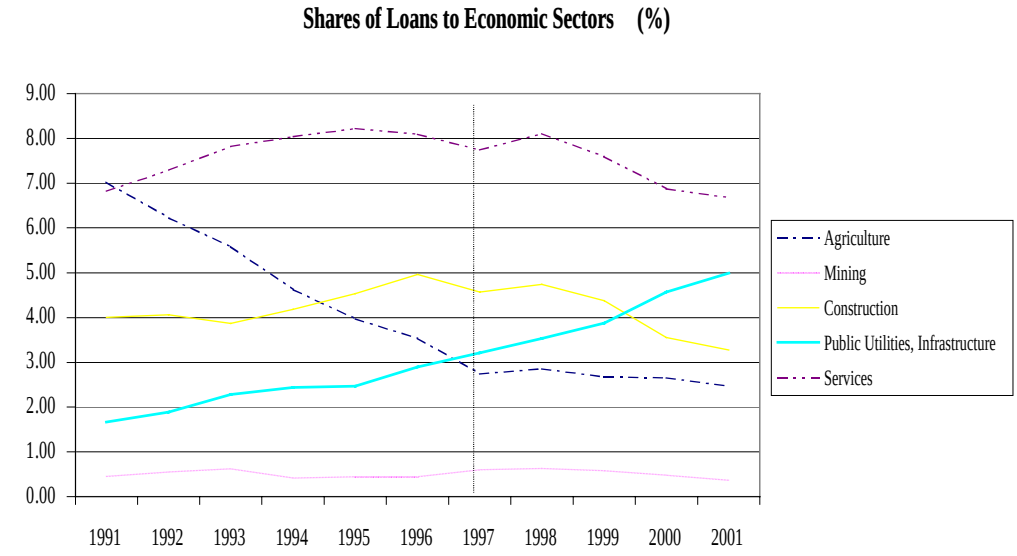
3.2 Composition of Loan Portfolios

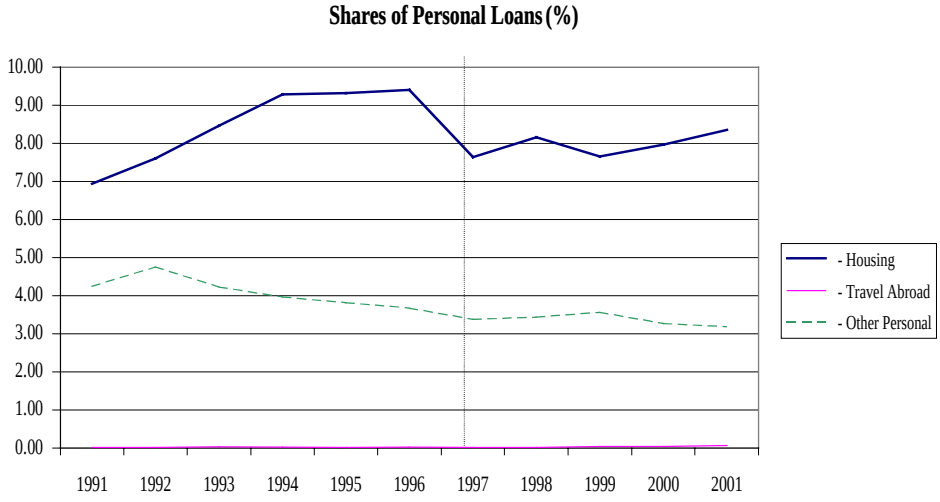
As aforementioned, experience from other countries indicated that capital constraint could lead to not only loan contraction but also loan portfolios shift from high risk-weighted to low risk-weighted loans. (Tallman and Bharucha, 2000) To investigate this issue for the case of Thailand, we first look at loan of the Thai banking system extended to 10 main business sectors, including Agriculture, Mining, Industrial, Construction, Trading, Financial Institutions, Real Estate, Public Utilities and Infrastructure, Services, and Personal, as described in call report: Table 33 [25]. It appears from Figure 13 that after the crisis in 1997, loans to financial institution sector, public utilities and infrastructure, and housing loans (which is the main component of personal loans) as a percentage of total loans have increased (from 6% to 20%, 3% to 5%, and 7% to 8.5%, respectively) while loans to other sectors as a percentage of total loans declined. According to the Bank of Thailand capital requirement as mentioned earlier, loans to financial institutions sector receive a risk weight of 0 if counter party is FIDF and the Bank of Thailand, and 0.2 if counter party is financial institution. While housing loans receive a risk weight of 0.5, loans to public utilities and infrastructure sector will have a risk weight of 0 and 0.2 if the counter party is government and public enterprise, respectively. That is, most of loans extended to all these three categories have a concessional risk weight of 0-0.5.

[25] Data on composition of loan portfolios are obtained from Call Report, Table 33 which are available on the Bank of Thailand's website for aggregated level data. The definition of loan to each sector can be obtained also from the BOT website.

Figure 13. Banking system's loan portfolio composition

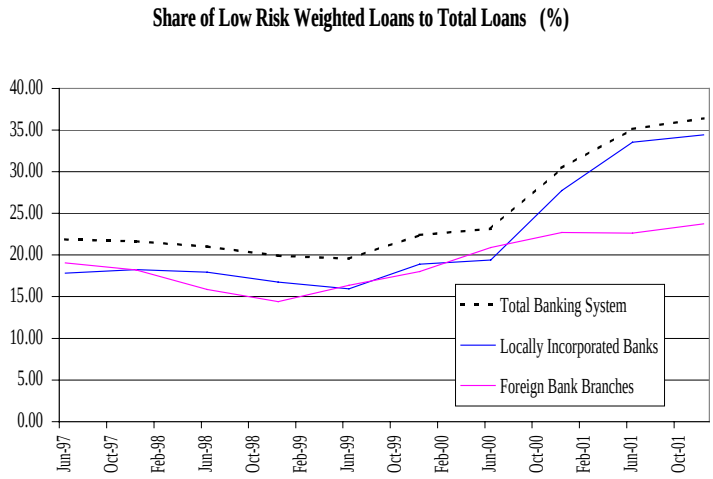






We next look at loan composition of each bank in Group 1 which unfortunately cannot be displayed here due to confidentiality of the data. It appears that four out of five banks made substitutions from high risk-weighted to low risk-weighted loans, including public utilities and infrastructure, financial institutions, and housing loans, consistent with total banking system data. The ratio of concessional risk-weighted loans (sum of these three categories of loans) to total loans increased from the range of 16 -22 % in 1998 to the range of 16-30% in 2002 in which the largest shifts was about 7% change.

Figure 14: Banking system's share of low risk-weighted loans to total loans (%)



4) Investigate the relationship between bank's condition and its lending behavior

4.1 Relationship with Loan Growth

As mentioned in the Methodology that we will investigate the evidence of credit crunch or supply side credit channel by examining the relationship between bank's condition and loan growth, given that demand faced by all banks are the same. In this step, we then calculate correlation coefficient of each measure of bank's condition (NPL ratio and the ratio of existing to required allowances for loan loss, and the BIS ratio) and loan growth rate, adding back series, in subsequent years of the five banks in Group 1. We use loan growth rate in subsequent period, 2000-2002, to eliminate the feed back of loan growth on bank condition, in other words, to control for one-way causality of bank condition on loan growth, not the other way around. (Bernanke and Lown, 1991). For bank's condition measures, we use the average of each ratio for each bank during 1998-1999 which is the period that NPLs

of the banking sector reached its peak, and the ratio of existing to required allowances for loan losses was below 100% since this seemed to be the period that banks were under pressure to raise their capital as required. After 2000 banks seemed to have some relief from capital constraint due to policy measures introduced during 1999-2001, including liberalization of foreign ownership, the government's capital support scheme (The August 14 Packages), recapitalization efforts using hybrid capital, and the establishment of private and national asset management companies, as explained earlier.

Table 6. Correlation coefficients of NPL ratio and subsequent loan growth (adding back series)

Loan Growth Rate (%)	NPL Ratio (%)			
	1998-1999	1998	1999	2000
2000-2002	-0.40			
1999		-0.70		
2000			-0.35	
2001-2002				-0.19

Table 7. Correlation coefficients of existing to required allowances for loan loss and subsequent loan growth (adding back series)

Loan Growth Rate (%)	Existing to Required Allowances for Loan Loss (%)			
	1998-1999	1998	1999	2000
2000-2002	-0.44			
1999		0.21		
2000			-0.13	
2001-2002				-0.60

Table 8. Correlation coefficient of BIS ratio and subsequent loan growth (adding back series)

Loan Growth Rate (%)	BIS Ratio (%)			
	1998-1999	1998	1999	2000
2000-2002	-0.24			
1999		-0.02		
2000			0.14	
2001-2002				0.20

Correlation coefficients in Table 6, Table 7, and Table 8 indicate that for banks in Group 1, all three variables of bank condition during 1998-1999 had no significant relationship with subsequent loan growth, after adding back write-offs and NPLs transfers, during 2000-2002. To complement the analysis in macro level, we investigate further which period the evidence of supply-side loan contraction existed by splitting the period and detecting the relationship in each year. The results show that NPL ratio in 1998 significantly and negatively correlated with loan growth in 1999 but this relationship fade away in subsequent period. Existing to required allowance for loan loss in 2000 also showed negative, but smaller correlation with loan growth in 2001-2002. Since in 2000 existing allowances of five banks were already higher than the required amount, this negative correlation is more likely to reflect the bank's perceived risk on future loan loss, thus provisioning more and restraining new loan extension. Therefore, we conclude that if there was any relationship between the bank capital condition and loan growth for banks in Group 1, it should have existed only during the first two years of the contraction period. These findings fit well with results from our macro level analysis, namely that there was significant supply-side pressure during the early stage of the contraction period but the pressure has since faded away[26].

[26] Attentive readers may notice that we jump to this conclusion based solely on the results of Group1 banks. We believe this is justified for two reasons. First, the five banks under study account for more than 60% of total bank loans. Second, if the data of the intervened banks (Group 2) could be disaggregated properly, they would likely not affect our conclusion. The intervened banks suffers tremendously from their NPL problem early in the crisis, yet enormous amount of subsequent transfers of their NPLs to public AMCs means they are less likely than the private banks to be NPL constrained.

4.2 Relationship with Loan Portfolio Composition

As mentioned earlier that most banks in Group 1 have shifted their loan portfolios toward lower risk-weighted loans including public utilities, housing loans, and loans to financial institutions after the crisis. We now investigate whether this portfolio shift was a result of supply side variable, a bank condition , by calculating correlation coefficient of each measure of bank condition: NPL ratio, BIS ratio, and existing to required allowance for loan loss, during 1998-1999 and the change in the ratio of concessional risk-weighted loans (sum of these three categories of loans) to total loans from 1998 - 2002, as shown in Table 8.

Table 8. Correlation coefficient of loan portfolio and measures of bank condition

	Change in the Ratio of Concessional Risk-weighted Loans to Total Loans (1998-2002)
NPL Ratio (1998-1999)	-0.51
Existing to Required Allowances for Loan Loss (1998-1999)	-0.008
BIS Ratio (1998-1999)	0.37

Correlation coefficient of NPL, BIS ratios and loan portfolio change are all insignificant though those of NPL and BIS ratios show unexpected sign. Our assumption was that banks with relatively high NPL or low BIS ratio would try to reduce its burden on capital requirement or avoid default risk of borrowers by lending more to low perceived or regulatory risk sectors, thus correlation coefficient should have positive sign for the former and negative sign for the latter. For the ratio of existing to required allowance for loan loss, the coefficient is zero, indicating no relationship with loan portfolio change.

Thus we conclude that the loan portfolio shift toward low risk-weighted sectors, including loans to financial institutions, public utilities and infrastructure projects, as well as housing loans, after the crisis should be driven mainly by demand-side factors, including slowdown in private investment and increase in government projects as well as demand for housing from household sector.

Our micro level analysis has limitation that is the variables used as measures of bank condition, namely: NPL ratio, existing to required allowance for loan loss, and BIS ratio.

reflects both the bank's ability and willingness to lend, which we cannot distinguish in our micro analysis. Therefore, findings from our micro level analysis must be used as complements to, not substitute for, macro level analysis. We do not try some other variables which can also be used as measures of bank's condition such as NPL re-entry rate, new NPLs, successful rate of restructured loans, etc., mainly due to simplicity in our statistical calculation purpose.

5. Conclusions

The unprecedented decline in bank credit post 1997 has an important implication for Thailand's current economic recovery. The country's heavily dependence on bank finance and the sheer, though not exceptionally large, size of the banking sector relative to the economy implies a meaningful rebound in bank credit growth as an integral part of broad-based and sustained economic growth.

This paper employs both macroeconomic and microeconomic analyses to systematically investigate both the root cause of the 1998 collapse in bank credit and the factors behind the current sluggish credit expansion. In doing so, the paper hopes to bring some closure to the supply-or-demand debate as well as to see whether additional structural measures are warranted.

Our econometric results suggest that supply factors were the main culprit behind the initial collapse in bank credit in early 1998. The decline in the estimated credit supply function preceded the decline in estimated demand by about three months, indicating the presence of a credit crunch. However, from the second half of 1998 onwards, both estimated demand and supply appeared to be more or less moving together. The decline in commercial banks' lending capacity accounted for much of the downward pressure on credit supply while weak credit demand can be attributed to macroeconomic condition.

Our micro level analysis shows that high NPL ratio, one of the missing variables from econometric estimation in 1998 significantly contributed to the observed bank lending contraction in 1999. However, this relationship has faded away in subsequent period. We did not find any significant relationship between the BIS ratio, a more direct measure of the bank's capital condition, and subsequent loan growth. These results suggest that, at least for

the five major banks under study, capital constraint did not seem to pose a problem to bank lending decision from 2000 onwards.

In retrospect, that our analyses failed to find significant role of capital constraints in the recent credit downswing is not so surprising. The Thai authorities has proactively done a great deal attacking Thai banks' capital inadequacy problems even before the decline in bank lending became apparent. The fading relationship between NPL ratios and banks' loan growth also suggests that the establishment of both private and public AMCs was an effective move to clean banks' balance sheets. To take our result further, had the AMC s been in operation earlier, the contraction in bank lending may not have been this severe.

Finally, both the macro level and micro level analysis strongly suggest that the worst time is behind us. Lending capacity and NPL overhang, both of which appeared to play a prominent role during the early stage of the contraction period are no longer major constraining factors recently. As the economy continues to improve, the recovery in bank lending should gain more strength. Nonetheless the experience of the previous credit cycles suggests that it can take a while before bank lending returns to normal. So we may have to be a bit patient.

Important policy implications can be drawn from our findings. Most importantly, it appears that things are progressing in the right direction. We believe that credit should be given to measures by the Thai authorities as well as those by the private banks. Nonetheless, there are still some risks to sustainable credit growth recovery. In the short term, the most important risk is probably NPLs. This paper finds that at a high NPL level, there is a strong negative association between the NPL ratio and loan growth. Although our result suggests that there is no connection between the two at the current level of NPLs, such risk cannot be totally ignored. Given the window of opportunity presented to us by the current economic recovery (which will further alleviate the NPL problem anyhow), we believe that two areas need full attention from both the authorities and the private banks themselves. First, there is a need for both state and private banks to strengthen their credit risk management capabilities. This will significantly ease problems of new NPLs. Second, there should be clear measures to support the debt restructuring process of both the AMCs and the banks themselves. Effective debt restructuring will go a long way at helping banks to combat re-entry NPL problems. Only when the NPL risk is contained will we be ensured of sustainable credit growth. Finally, for longer-term policy, there is a need to speed up the development of the

Thai capital market so as to reduce the private sector's heavy dependence on banks. Should the next credit downturn arrive, its effect on the economy will not be as severe as the recent credit contraction.

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Appendix A. Data Description and Sources for Aggregate Level Analysis

Variables	Description	Sources*
Real private credit	Claims on private credit; deflated by CPI; logarithm	Table 8.1
Real lending capacity	Total commercial bank deposits plus liabilities less required liquid assets; deflated by CPI; logarithm; lagged one period	Table 8; Table 10; Table 16; Table 9 (Financial Institutions Data)
Lending rate	Average of MLR; deflated by 6-month ahead annual CPI inflation	Table 30
Deposit rate	Average of 3-6-month time deposit rate	Table 30
Manufacturing production	Manufacturing Production Index; seasonally adjusted; 3-month backward moving average; logarithm	Table 69
Stock market index	End of month SET index; 3-month backward moving average; logarithm	SET
Consumption	Private Consumption Index; 3-month backward moving average; logarithm	Table 73.1
Expected investment	Private Investment Index; 3-month forward moving average; logarithm	Table 73.2
Consumer Price Index	Headline consumer price index	Table 79

* Unless otherwise indicated, all data sources are from Bank of Thailand homepage under Data Bank/Economic Data/Economics and Financial Statistics

Appendix B. Timeline of Key Financial Sector Restructuring Measures (1998-2002)

Timing	Key Restructuring Measures
March 1997	BOT ordered 9 finance companies and 1 credit foncier to raise capital
June 1997	BOT suspended the operations of 16 finance companies.
July 1997	BOT floated the Baht.
August 1997	BOT suspended the operations of 42 finance companies. The blanket guarantee for depositors and creditors was introduced.
October 1997	FRA and public AMC were established.
November 1997	BOT intervened in BMB.
	Liberalization of foreign ownership in financial institutions.
December 1997	FRA ordered 56 finance companies closed.
February 1998	BOT intervened in SCIB and FBCB.
	RB was introduced.
April 1998	FRA conducted the first auction of core assets.
May 1998	BOT intervened in 7 finance companies.
June 1998	Ministry of Finance issued Bt500b bonds to fiscalize FIDF's losses.
	CDRAC was established.
August 1998	BOT intervened in LTB, UB, and 5 finance companies.
	BT was established by merging UB, KTT, and 12 finance companies.
	LTB and RB were merged.
	BBC was closed down.
	FBCB was merged into KTB.
	The public capital support scheme was introduced.
	Private AMC Law was introduced.
February 1999	TFB issued SLIPs.
April 1999	BBL issued CAPs.
July 1999	BOT intervened in NTB.
September 1999	NTB was sold to Standard Chartered Bank.
October 1999	RB was sold to UOB.
September 2000	KTB's NPLs were transferred to SAM.
April 2001	TAMC was established.
June 2001	BMB's and SCIB's NPLs were transferred to PAM.
October 2001	The first lot of NPLs were transferred to TAMC.
April 2002	BMB was merged into SCIB.

Source: Santiprabhob, V. 2002. "Lessons Learned from Thailand's Experience with Financial Sector Restructuring" (Preliminary Draft)